ENHANCING SOURCE WATER PROTECTION IN RURAL REGIONS: EXPLORING THE ROLE OF CAPACITY AND COLLABORATIVE WATERSHED GOVERNANCE IN RURAL ONTARIO

by © Sarah Rose Lynda Minnes. A dissertation submitted to the School of Graduate Studies in partial fulfillment of the requirements for the degree of

Doctor of Philosophy

Memorial University of Newfoundland

September 2018

St. John's Newfoundland and Labrador

Abstract

The primary goal of this research was to examine the implementation of Ontario's source water protection (SWP) policies and explore implications for rural regions. The research was particularly focused on relationships between the implementation of the *Clean Water Act, 2006, S.O. 2006, c. 22* (CWA) and capacity, as well as collaboration in governance, two areas identified as key concerns in other contexts. The research explored the successes and challenges with SWP planning and implementation in Ontario, implications of the CWA for capacity building and collaborative watershed governance, as well as the available capacity for SWP in privately-serviced areas. This research derived findings from 30 key informant interviews conducted in two case study areas in Ontario (the Cataraqui Source Protection Area and the North-Bay Mattawa Source Protection Area), extensive document and literature review, and member checking.

The SWP process under the CWA raised capacity for SWP in the rural municipalities impacted by the legislation and has contributed positively to enhancing collaborative watershed governance in the province. Particularly, the CWA improved communication, collaboration, transparency, integration, knowledge sharing, and trust amongst watershed actors. However, there needs to be careful attention as the program continues to support the capacity built. The lack of a reliable financial commitment to the process by the provincial government disproportionately impacts rural communities, which often lack the internal technical and financial capacity for SWP. The absence of a continued provincial commitment to the SWP program under the CWA (financially and otherwise),

will impact the collection and maintenance of required data and monitoring of source water supplies, enforcement of source protection plan policies, and public outreach and education efforts. Furthermore, greater attention to flexibility for identified local concerns is important. The CWA's focus on SWP for exclusively municipal drinking water systems left privately-serviced communities out of the process. A new, strategic, implementable, and integrated institutional framework for SWP in privately-serviced areas needs to be created, together with capacity building efforts for these areas, in order to properly protect all drinking water sources in rural Ontario.

Acknowledgements

First and foremost a warm and grateful thank you to the participants in this research for their kind donation of their time and expertise during sometimes very lengthy interviews. Particularly, thank you to Cataraqui Region Conservation Authority and North Bay-Mattawa Conservation Authority for their support of this research, and helpful guidance. This research would not have been possible without the steadfast and kind support of my supervisors Drs. Kelly Vodden, Robert Scott, and Maura Hanrahan. Thank you to Kelly who encouraged me to do my PhD and for always finding a way to support me in making my professional and personal aspirations possible. A special thank you to Dr. Nick Novakowski, who was tragically taken from us in 2015. Nick provided me caring mentorship, that laid the foundation to this research. Thank you to Dr. Hugh Simpson for lending his friendly expertise and encouragement at a time when I was drowning in data. Thank you to my dear colleagues (Sarah Breen, Heather Hall, Valencia Gaspard, Ryan Gibson, Brennan Lowry, and many more!) for creating an environment of support and laughter throughout my scholastic and professional pursuits.

This research would not be possible without the generous support of the Rural Policy Learning Commons, MITACS-internship program, and The Harris Centre- RBC Water Research and Outreach Fund. In addition, thank you to the Interdisciplinary PhD program at Memorial University of Newfoundland for funding me throughout my entire degree.

Lastly, thank you to my friends and family who got me through this degree. Thank you to

my friends for your compassion, reassurances, and loyal friendships (Alyssa, Sarah, Jodi, Sherri, Kelley, Laura, and many more!). Thank you to Brian and Venita Bailey for housing me throughout my studies in Corner Brook. Thank you to my in-laws (Shelley, Jim, Kate, and Jess) for their support, whether it was babysitting, encouragements, or much needed stress relief. Thank you to my brother Matt for mentoring me through this arduous process and inspiring me to think critically and pragmatically at every stage. Thank you to my brother John, for keeping me humble, and motivating me with your perseverance and work ethic. Thank you to my late grandparents (Belle, Melita, Graham, and Victor) for seeing the value in investing so much of their time in my upbringing and financial resources to my education. I would not be where I am today without their everlasting love and support. Thank you to my loving parents (Lorie and Dave), life-long environmental educators, who instilled in me a passion for nature, rural Canada, and learning. Thank you for your endless support. Your unconditional and unyielding love has given me the strength to never give up on my dreams, and to always believe in myself.

Thank you to my husband Andy for everything (I could write a book on this particular subject). In direct pertinence to this dissertation, thank you for your patience, support, and love throughout my educational journey. You support my ambitions as if they were your own, and I will forever be grateful for your partnership in life. Lastly, thank you to my sweet son James. You are a constant source of inspiration, hope, and motivation to strive towards the sustainable stewardship of this beautiful planet.

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List of Abbreviations

Abbreviation	Definition
CA Participant	Conservation authority/Conservation Ontario staff
CSPA	Cataraqui Source Protection Area
CWA	*Clean Water Act, 2006, S.O. 2006, c. 22*
MOECC	Ministry of the Environment and Climate Change
Municipal Participant	Upper/lower tiered municipal staff and elected officials
NBMSPA	North Bay Mattawa Source Protection Area
NMA	*Nutrient Management Act, 2002, S.O. 2002, c. 4*
Other Participant	Non-governmental expert or consultant
OWRA	*Ontario Water Resources Act, 1990, R.S.O. 1990, c. O.40*
Provincial Participant	Provincial staff
SPC Participant	Source protection committee member
SWP	Source water protection

1. Introduction and Overview

1.1. Introduction

This chapter introduces the research undertaken, including objectives, research questions, rationale, context, and limitations of the research. The chapter will end with a general overview of the organization of this dissertation, as well as a co-authorship statement.

In 2010, the United Nations General Assembly recognized the human right to water and sanitation, emphasizing the importance of water globally (United Nations, 2015). Drinking water is required for any human inhabited community and is an important facet of not only environmental health, but economic development, and overall community resilience (Hammond & Bradley, 2005; Wong & Brown, 2009). In Canada, recent studies have shown that source water protection (SWP) is an essential component of a holistic approach to drinking water management (Canadian Municipal Water Consortium, 2014). SWP refers to efforts to protect surface and groundwater sources that are used for drinking water (Patrick, Kreutzwiser, & de Loë, 2008) and is a first line of defense to ensure drinking water safety (de Loë & Kreutzwiser, 2005). SWP reduces costs of water treatment and enhances drinking water safety (de Loë & Kreutzwiser, 2005). However, the implementation of SWP policies and plans requires a certain level of technical, institutional, financial, and social capacity (Rawlyk & Patrick, 2013). As discussed further in Chapter 2, lack of capacity is often a barrier to SWP, especially in rural communities (Kot, Castleden, & Gagnon, 2011; Minnes & Vodden, 2014).

The Ontario *Clean Water Act, 2006, S.O. 2006, c. 22* (CWA) was created specifically to better protect drinking water supplies by building capacity in local areas (Ontario Ministry of Environment, 2006a). SWP under Ontario's CWA is designed to be an integrated, science-based approach, using local multi-stakeholder source protection committees to create source protection plans on a watershed basis (Ontario Ministry of Environment, 2006a). Implementation of the CWA is currently underway in Ontario (North Bay-Mattawa Conservation Authority, 2015), offering promise as a model from which other jurisdictions can learn (Mitchell, Priddle, Shrubsole, Veale, & Walters, 2014). This dissertation uses both a capacity framework and a collaborative watershed governance framework to explore the implications of Ontario's SWP policies and implications for rural regions. This research examines SWP policies for both municipally serviced areas (i.e. areas relying either partially or fully on a municipally operated drinking water system[1]) and privately-serviced areas (i.e. areas relying either partially or fully on private drinking water systems such as private groundwater wells).

1.2. Objectives and Research Questions

The primary goal of this research was to examine the implementation of Ontario's SWP policies and explore implications for rural regions and for enhancing capacity for SWP in these regions. This research used the Ontario Ministry of Agriculture, Food and Rural Affairs' definition of rural, which considers rural as all Statistics Canada's census

[1] The terms "municipally serviced" and "serviced" are used synonymously throughout this dissertation, and refer to areas relying either partially or fully on a municipally operated drinking water system.

subdivisions (including lower tier and single tier municipalities) that meet at least one of the following criteria, as per the latest Census of Population: have a population of less than 100,000 people and/or have a population density of 100 people/km^2 or less (Ontario Ministry of Agriculture Food and Rural Affairs, 2017).

The research questions asked were:

1. What have been the successes and challenges with SWP planning and implementation in Ontario?
2. Did the SWP planning process under Ontario's CWA build capacity for SWP in municipally serviced rural municipalities?
3. Do privately-serviced rural municipalities in Ontario have the capacity for SWP?
4. To what extent has the CWA been an example of collaborative watershed governance?

1.3. Rationale, Methods, Case Studies, and Limitations

1.3.1. Rationale

The rationale of this research is to provide lessons about SWP in Ontario with an emphasis on the rural experience. Ontario municipal drinking has been called the, "best protected in the world" (Environmental Commissionner of Ontario, 2017, pg.32), suggesting Ontario's approach to SWP is a model process. Though there is a great deal of literature surrounding SWP in Ontario, there is a lack of literature that focuses on rural areas, and even less of this literature focuses on SWP for privately-serviced areas

(Kreutzwiser et al., 2011). Given the importance of protecting drinking water supplies and the challenges for rural communities to enact SWP (Minnes & Vodden, 2017), ensuring effective implementation of the CWA and other SWP policies across the province, including rural areas, is essential. In addition, rural communities elsewhere can benefit from learning about the SWP mechanisms currently in place in Ontario. This research provides lessons for rural Canada and beyond on rural SWP by examining rural Ontario's experience with their recent SWP efforts.

An interdisciplinary approach has been stressed in the literature as imperative for the study of complex ecological systems such as watersheds, which are impacted by a range of other, intersecting, social, political, and economic systems (Berkes & Ross, 2013; Sayre, 2015; Theobald, Spies, Maxwell, Hobbs, & Dale, 2005). This interdisciplinary research draws from the disciplines of geography, political science, and environmental science. Each research question draws on literature from all three disciplines. Particularly, the concepts of capacity and collaborative watershed governance have been employed to address the research questions outlined in Section 1.2. The importance of these concepts in relation to SWP are further elaborated upon in Chapter 2. This research has refined and added to the frameworks for capacity for SWP provided by Rawlyk and Patrick (2013) (see Table 2.1) and has evaluated these elements and indicators in real life applications in Ontario rural communities. Similarly to capacity frameworks for SWP that are new and evolving, there is no concrete theory for governance to date (Emerson, Nabatchi, & Balogh, 2012; Stoker, 2004). This dissertation has further defined the concept of collaborative watershed governance (see Table 2.4) and explored these emerging

elements and indicators. This research contributes to theory building for collaborative watershed governance by drawing from and further advancing evolving collaborative governance frameworks such as those provided by Ansell and Gash (2008) and Plummer and Armitage (2007).

Capacity and collaborative watershed governance were deemed appropriate lenses for this research, given the Ontario government's focus on capacity building for SWP via the CWA and their use of multi-stakeholder source protection committees to create source protection plans under the CWA (Ontario Ministry of Environment, 2006a). Furthermore, examining the capacity for SWP helps evaluate if the rural case study regions being used for the research have the proper ability to enact SWP and helps identify how capacity might be enhanced. In addition, the governance structures under the CWA are arguably examples of collaborative watershed governance (see Chapter 5). It was the aim of this research to look beyond the often reductionist scope of SWP, to evaluate what these SWP processes under the CWA has meant for overall watershed governance in the case study regions (using a collaborative watershed governance framework). Findings of this research provide lessons from the Ontario experience that can enhance SWP in Ontario and other rural areas nationally and internationally, as well as contribute to theory building, particularly for collaborative watershed governance.

1.3.2. Methods

A case study approach was employed in this research (Yin, 2011) to allow for in depth exploration of the experience within two predominately rural regions in Ontario. The two

source protection areas chosen were the Cataraqui Source Protection Area (CSPA) in eastern Ontario and the North Bay-Mattawa Source Protection Area (NBMSPA) in 'near north' Ontario. Both case study regions were chosen because of their largely rural composition (see Section 1.2 for the definition of rural used in this research). Most source protection areas/regions in Ontario are located in southern Ontario (see Figure 1.1), where it is difficult to find a grouping of predominantly rural communities. The two cases study areas chosen were chosen due to their similarity in being geographically very rural (even though there are major urban centres in each area). Also, each case study area was a source protection area (rather than a region which is a grouping of one more conservation authority boundaries). Choosing two source protection areas facilitated easier comparative analysis. The researcher already had done previous research in the CSPA and had familiarity with the NBMSPA, so had the benefit of already having contextual understandings of both areas. Due to this previous experience with both regions, the researcher was sensitive to any preconceived biases and did her best to eliminate any bias throughout the research.

The research began with an extensive literature review and document analysis (e.g., academic literature, related reports, resources, SWP legislation, regulations, and policies, and other related documents such as websites, meeting minutes, etc.). Academic literature review was used to understand SWP more generally and to refine the SWP capacity and collaborative watershed governance conceptual frameworks used in this research (see Tables 2.1, 2.4, and A4.1). It should be noted that the research question relating to privately-serviced rural municipalities (question 3) was added to the research project after

field work had begun. The conceptual framework used for SWP capacity had to be slightly modified for privately-serviced areas during analysis (see Table A4.1). From the conception of the research, privately-serviced municipalities were of interest, and questions relating to these areas were included at a high level in the interview guides used (see Appendices 8.1 and 8.2). However, the interview guides for this research were focused on SWP capacity for municipally serviced areas impacted by the CWA (with a particular emphasis on rural). After the first two interviews were conducted with conservation authority representatives from both case study areas, it was evident that privately-serviced areas were of great concern in both case study regions, and research question 3 was added to the study.

Semi-Structured Key Informant Interviews

Thirty-one key informant interviews were conducted with various stakeholders in the both case study regions as well as with select key informants having a provincial perspective (see Table 1.1). One key informant decided to withdraw their information from the study, resulting in n= 30. All key informant interviews were conducted in confidentiality as per the informed consent process. The Grenfell Campus (Memorial University) Research Ethics Board found the research to be in ethical compliance with the Canadian Tri-Council Guidelines (reference number 20161916).

Key informants were targeted based on their familiarity with the rural context as well as their role within the source protection planning and implementation process. The researcher began with first contacting representatives who were part of the source

protection committees for each case study areas. The snowballing method was also employed, by asking interviewees for additional key informants. Semi-structured interviews were conducted using one interview guide (one for regional interviewees and a separate guide for those with a provincial perspective) (see Appendices 8.1 and 8.2). Interviews ranged from 1-3 hours on average. Due to the informal nature of the interview style used (semi-structured interviews allowed for more of a conversational style interview), most participants were extremely generous with their time and knowledge of the subject area. A total of 15 interviews were conducted in person, and 15 interviews were conducted via telephone.

Table 1.1. Key Informant Interviews Analyzed (n = 30)

Sector	**Identifier in Article**	**Total**	**CSPA**	**NBMSPA**	**Ontario Wide**
Source protection committee member	SPC Participant	9	4	5	0
Provincial staff	Provincial Participant	4	3	1	0
Upper/lower tiered municipal staff and elected officials	Municipal Participant	8	4	4	0
Conservation authority/Conservation Ontario staff	CA Participant	5	2	1	2
Non-governmental expert or consultant	Other Participant	4	0	1	3
Total		30	13	12	5

The researcher stopped data collection at 30 interviews, as this was when she felt a saturation point had been met, and she was hearing the same information being repeated in interviews. Furthermore, at the end of data collection the researcher had interviewed all all source protection committee members who were willing to be interviewed (each

source protection committee member for each source protection area was solicited either directly or by the conservation authority for an interview), and the researcher had followed up on any leads for additional informants.

Analysis

Coding of interview transcripts (in one case interview notes) was conducted using NVivo qualitative research software. Key informant responses were coded according to each element of the conceptual frameworks used (see Tables 2.1, 2.4 and A4.1), using the indictors as guides, but also allowing for additional indicators found in the interviews that may fit within one or more of the elements being explored. After general coding was conducted, the researcher went back to each code (e.g., elements of the conceptual frameworks used) and recoded the data as either demonstrating a presence or absence of the element. The percentage of interviews in each case study region, and from Ontario wide interviews that discussed the element and confirmed through their answers the presence or absence of the element were calculated following the re-coding. These percentages were used to display a general overview of what participants were indicating in their interviews. These percentages do not show any statistical significance and are simply descriptive. Subsequently, the data from the presence/absence codes were analyzed for general re-occurring findings, and coded according to these findings. If three or more participants (10% of the sample) confirmed a finding, this was coded as a key finding, and the number of interviews confirming each key finding was tracked.

Lastly, member checking (i.e. ground truthing) was used to ensure all key findings were

reflective of the experiences in the case study areas (Birt et al., 2016). Member checking was done in three ways: 1) follow up meetings with select participants from the conservation authorities; 2) asking for quote approvals/clarification from some participants; 3) creating a knowledge brief on the key findings of Chapters 3-5 of this dissertation, with preliminary recommendations. Each participant was sent the knowledge brief document by email and given at least one month to respond. The feedback from this process informed the final findings and conclusions of this research.

1.3.3. Case Studies

As noted above, this research examined SWP in two source protection areas, in which the majority of communities can be classified as rural (based on the previously defined definition). Firstly, the CSPA in eastern Ontario (Figure 1.1) was chosen. The municipalities in the CSPA fit the definition of rural defined in Section 1.2 above, with the exception of the City of Kingston (population of 123,798 and population density of 274.4 persons/km^2) (Statistics Canada, 2018). The CSPA is located on the eastern shores of Lake Ontario and the upper part of the St. Lawrence River. The CSPA includes the Bay of Quinte, Hay Bay, the southern area of the Rideau Canal, and the Thousand Islands. The CSPA follows the boundaries of the Cataraqui Region Conservation Authority, which consists of all or part of 11 municipalities, with the addition of the Township of Frontenac Islands (Figure 1.2) (Cataraqui Source Protection Committee, 2014, p. 3). The diverse landscape of this region includes the Canadian Shield, limestone and clay plain agricultural areas, and areas of sand and gravel. The entire region shares the characteristic of thin or completely absent soil, with fractured bedrock. The majority

of residents (80% or approximately or 168,000 people) in the CSPA are served by either surface water (eight communities) or groundwater (three communities) supplied municipally operated water systems. The remaining approximately 42,000 residents derive their water from private systems (including shore wells and private groundwater wells) (Cataraqui Source Protection Committee, 2014).

Figure 1.1. Case Study Locations (Ontario Ministry of the Environment and Climate Change, 2009)

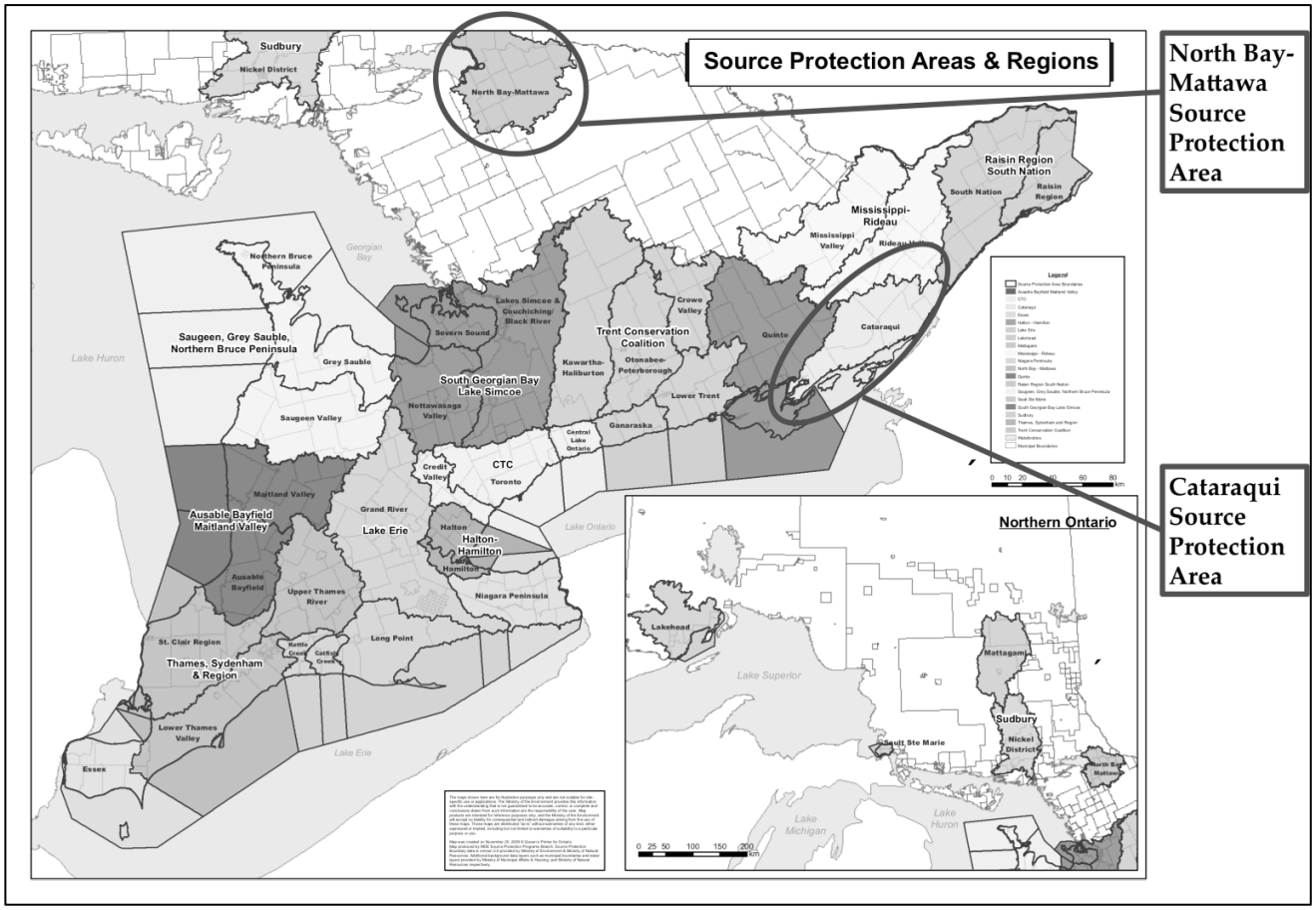
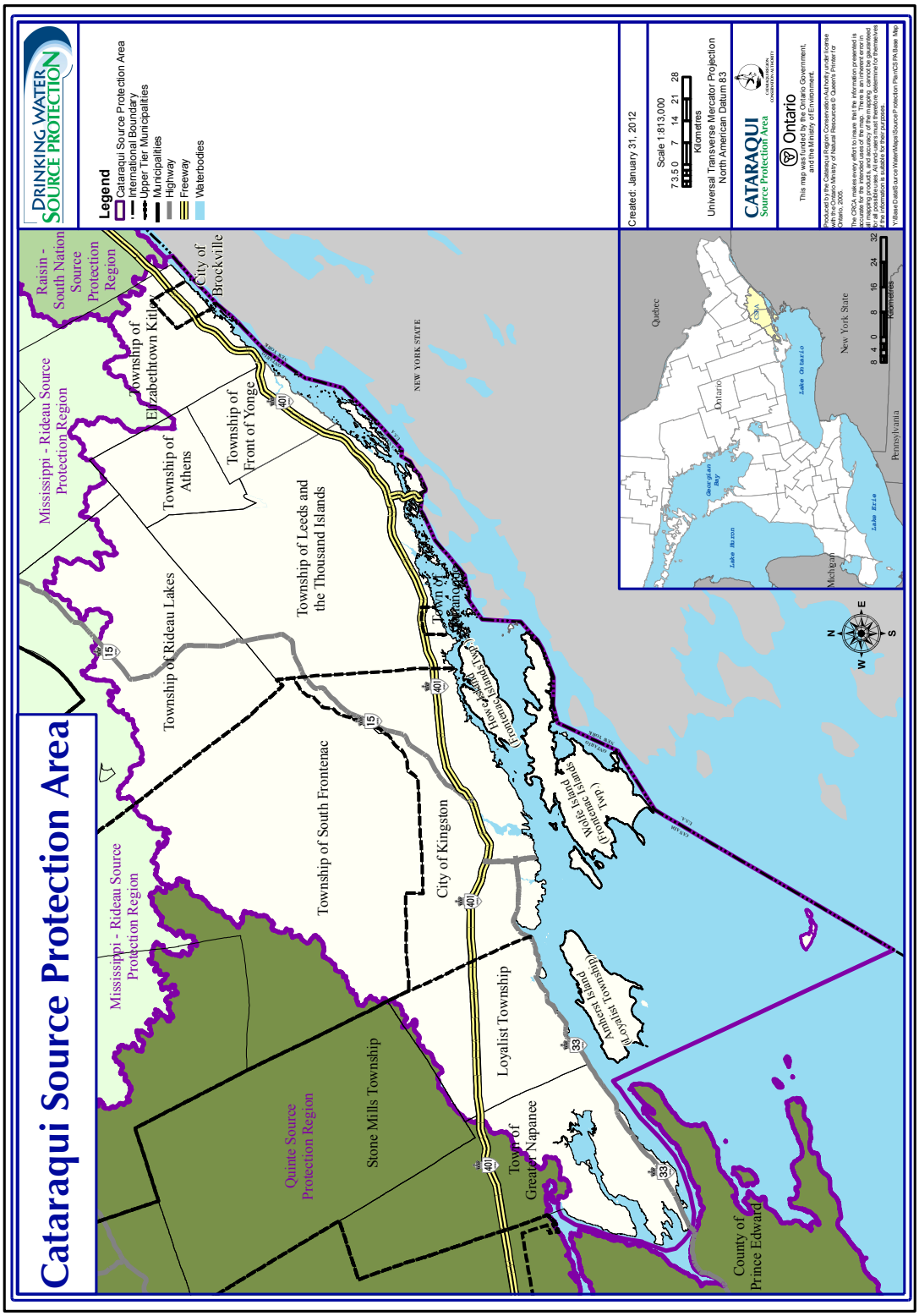


Figure 1.2. Cataraqui Source Protection Area (Cataraqui Source Protection Committee, 2014, p. 3).



The second source protection area chosen was the NBMSPA, located in northeastern Ontario (Figure 1.1). The NBMSPA covers 4,000km^2 from the Village of South River in the west to the Town of Mattawa in the east. The topography of the source protection area consists of three distinct regions: The Northern Upland, the Algonquin Highland, and the Nipissing-Mattawa Lowland. Cutting across the region north to south is a major divide, that directs water flow either toward Lake Nipissing and the Great Lakes, or to the Mattawa River and Ottawa (North Bay-Mattawa Source Protection Committee, 2012). Within these two large watersheds are 14 sub-watersheds (Figure 1.3). The total population of the NBMSPA is estimated to be 74,500 residents, with ten full municipalities, and four partial townships within its boundaries, as well as the First Nation[2] Reserve of Nipissing 10 that is partially located within the NBMSPA (North Bay-Mattawa Source Protection Committee, 2012). This predominantly rural region has one major 'urban' center, the City of North Bay (that contains 75% of the source protection area's residents). The City of North Bay has a population of 51,553 residents and a population density of 161.6 persons/km^2 (Statistics Canada, 2018). Under the definition of rural provided in Section 1.2, the City of North Bay would be considered rural, as well as all other municipalities in the NBMSPA. The NBMSPA has five municipal drinking water systems (serving a population of 58,951 residents), with three systems that rely on surface water as their source and two systems deriving its water from groundwater

[2] For the purposes of this research First Nation refers to communities and people within those communities designated as a reserve as defined in the *Indian Act* (Canada) that are excluded from the CWA unless they choose to opt in (Ontario Ministry of Environment, 2006a, Part V, 109(6)). The term Indigenous refers to all First Nations, Inuit, and Métis peoples of Canada.

supplies. Two hundred and eighty-seven residents (mainly in apartments, trailer parks, schools, and long-term care facilities) in the NBMSPA area derive their water from non-municipal systems recognized under the *Safe Drinking Water Act, 2002* and subject to regulation under O.Reg 170/03. The majority of the remaining members of the population (an estimated 15,262 residents) gets its drinking water from private residential wells or surface water intakes (North Bay-Mattawa Source Protection Committee, 2012).

1.3.4. Limitations

A major limitation of this study is the inclusion of the Indigenous perspective in SWP in Ontario. There were no First Nation communities located within the CSPA, and only one First Nation community located within the NBMSPA. This resulted in an inadequate data set related to the Indigenous perspective. A further limitation of the study is that it was originally only focused on the implications of the CWA for rural serviced municipalities (as can be seen by the questions in the interview guides in Appendices 8.1 and 8.2). Despite the interview guide being focused on the implications of the CWA for rural serviced municipalities, many interviews either partially or entirely focused on concerns related to SWP for privately-serviced rural areas. A substantial amount of data related to research question 3 was derived from the dataset despite this not being the original intent of the study. This data has been included in this dissertation (Chapter 4), however, further research focused solely on SWP in privately-serviced areas is required.

Figure 1.3. North Bay- Mattawa Source Protection Area Subwatersheds (North Bay-Mattawa Source Protection Committee, 2012, p. 13)

1.4. Organization of Dissertation

This dissertation is made up an extensive literature review section and three academic articles, along with a summary of all findings of the research and final conclusions. In Chapter 2, Section 2.2 further defines SWP. Section 2.3 outlines the capacity literature as it specifically relates to SWP, offers further justification of the central importance of the topic of capacity within this area, and provides the elements and indicators of capacity for SWP used in this research. Section 2.4 goes into detail about SWP tools that can be used specifically for privately-serviced areas. Section 2.5 outlines the current literature on collaborative watershed governance (linking this back to specifically SWP) and provides the elements and indicators of collaborative watershed governance investigated in this research.

Chapter 3 addresses research questions 1 and 2, and outlines the findings related to the successes, challenges, and implications that the CWA had for the building of SWP capacity for rural serviced municipalities (i.e. those municipalities with public drinking water systems). Chapter 4 displays findings on research questions 1 and 3. Chapter 4 asks if there is capacity for SWP in the context of privately-serviced rural areas (i.e. those areas relying on private drinking water systems such as private groundwater wells), and also includes consideration of legislation and policies outside of the CWA that influence SWP in these areas. Chapter 5 returns to implications of the CWA specifically, and speaks to research questions 1 and 4. Chapter 5 examines the effect the CWA has had for collaborative watershed governance in rural watersheds in Ontario, considering impacts on both public and private drinking water systems. Chapter 6 links together and

summarizes the findings presented in Chapters 3-5, provides recommendations for policy and practice and directions for future research, and delivers final thoughts on the implications of this research for SWP in rural Ontario and beyond. Chapter 6 also provides implications of this research on furthering collaborative watershed governance theories and approaches as well as SWP capacity frameworks. Chapter 7 contains a full bibliography for the dissertation, and Chapter 8 includes appendices of interview guides used during the research and the knowledge briefs related to Chapters 3-5.

1.5. Co-Authorship Statement

Sarah Minnes (with the help of her supervisory committee) designed the research proposal, undertook all the data collection, and conducted all of the analysis. With the exception of Chapter 4, Sarah Minnes solely wrote the entire dissertation. Dr. Hugh Simpson, was asked to co-author Chapter 4, due to his expertise in the subject matter. Dr. Simpson was of great help in assisting Sarah Minnes in interpreting the results of the data collected, putting these results in context, and accurately inferring implications of the research. His contributions and expertise have indubitably strengthened this dissertation as a whole. Nevertheless, the vast majority of the analysis and writing for Chapter 4 was completed by Sarah Minnes.

2. Background Literature Review and Conceptual Framework Overview

2.1. Introduction

This chapter provides a literature review of the major topics, concepts, and conceptual frameworks used in this research. Section 2.2 outlines what is meant by source water protection (SWP), and why it is important. Section 2.3 explains the importance of capacity for SWP and how capacity for SWP is conceptualized and analyzed in the literature as well as this research. Given their unique circumstances, Section 2.4 clarifies what is meant by SWP for privately-serviced areas and the methods and challenges associated with SWP in these communities. Much of Section 2.4 also applies to SWP for municipally serviced drinking water systems, and it is indicated throughout where this is the case. The scope of this literature review is focused on the context of Ontario, Canada. Section 2.5 summarizes the literature related to collaborative watershed governance, its relation to SWP, and explains how watershed governance is evaluated for the purposes of this research. Both conceptual frameworks included in this chapter (SWP capacity and collaborative watershed governance) work towards theory building for these two concepts. However, this research does not "test" predetermined theories related to these conceptual frameworks, but uses these frameworks to explore the research questions based on the relevant literature (Vodden, 2009).

2.2. Source Water Protection[3]

Source water refers to the raw surface and ground water supplies such as lakes, rivers, and aquifers, used to supply public and private drinking water systems. SWP refers to efforts taken to protect these surface and groundwater source water supplies. Source water supplies can be vulnerable to contamination by several point and nonpoint sources of pollution. These include specific point source threats such as situations where there are direct spills and leaks of industrial chemicals into source water supplies, and more dispersed nonpoint pollution sources such as nutrients, bacteria, oil, metals, chemicals, and pesticides from agricultural or urban runoff (Eledi, Minnes, & Vodden, 2017). Outbreaks of waterborne disease in Canada have increased public awareness about the need to protect water quality and quantity, and the negative impact that water contamination can have on human health, the environment, and the economy (Canadian Council of Ministers of the Environment, 2004). For example, in 2000 a contaminated water supply in Walkerton, Ontario resulted in seven deaths and thousands becoming seriously ill (Ferreyra, de Loe, & Kreutzwiser, 2008). The report following the Walkerton Inquiry conducted by Justice O'Connor, drew attention to the need for an integrated SWP approach to managing potential impacts on drinking water sources (O'Connor, 2002b; Simpson, Duff, & Taylor, 2007). In addition, the benefits of avoiding contamination at the source are far greater than the financial costs of implementing protective measures

[3] With permission from the Rural Policy Learning Commons, Sections 2.2 and 2.4 have been adapted from the document prepared for the Rural Policy Learning Commons by the author entitled, "Source Water Protection in Privately Serviced Rural Areas: A Literature Review". The full document can be found here: http://rplc-capr.ca/wp-content/uploads/2018/02/Privately-Serviced-SWP_RPLC_Minnes.pdf

(Simpson & de Loë, 2014). The financial and social costs of not implementing SWP measures (e.g., remediation efforts, death, loss of trust in government, etc.) can prove to be very high (Simpson & de Loë, 2014). For example, remediation efforts after a contamination can cost 30 to 40 times more than SWP programs would have cost, with costs rising to as much as 700 times more costly in rural areas (Simpson & de Loë, 2014).

SWP ensures drinking water quality and quantity are not adversely impacted by land use activities, which vary depending on the local context of the watershed that contributes to the drinking water source (Ivey, de Loë, & Kreutzwiser, 2006; Simpson & de Loë, 2014). Examples of SWP efforts include: mapping of aquifers or recharge areas; assessing potential contaminants; instituting regulations to restrict potential contaminants in sensitive areas; and public education and outreach programs (de Loë, Di Giantomasso, & Kreutzwiser, 2002). An important approach to the governance and management of drinking water that emerged out of the Walkerton Inquiry, was the multi-barrier approach (Canadian Municipal Water Consortium, 2014; Ontario Ministry of the Environment, 2004). The multi-barrier approach includes the following elements in order to protect drinking water:

- Water quality monitoring and management of water supplies from source to tap (e.g., source waters, drinking water treatment and water distribution systems);
- Legislative and policy frameworks;
- Public involvement and awareness;
- Guidelines, standards, and objectives; and
- Research and the development of science and technology solutions (Canadian Council of Ministers of the Environment, 2004, p. 15).

SWP is an essential, cost effective, first step in the multi-barrier approach to drinking water protection (Eledi et al., 2017; Patrick, 2011; Simms, Lightman, & de Loë, 2010). As a result, SWP has become an important policy development in Canada in order to prevent contamination of drinking water used for human consumption (Ferreyra et al., 2008; Ontario Ministry of the Environment, 2004; Rawlyk & Patrick, 2013).

2.3. Capacity and Source Water Protection

The concept of capacity has many different meanings and different sub-concepts. For example, community capacity can be defined as, "the combined influence of a community's commitment, resources, and skills that can be deployed to build on community strengths and address community problems" (Mayer, 2002, p. 2). A growing body of literature acknowledges that capacity needs to be enhanced in Canada to achieve SWP (Medema, Mcintosh, & Jeffrey, 2008; Robins, 2007), and that especially in rural communities, capacity is often lacking for water management in general (Kot et al., 2011; Minnes & Vodden, 2014; Robins, 2007). Rawlyk and Patrick (2013) describe capacity for SWP as "the ability, or capability, of a local community to meet regulations, policies or standards that have been established" (p. 22). Four main categories of capacity related to SWP have been identified: institutional, technical/human, financial, and social. The framework provided in Table 2.1, adapted from Rawlyk and Patrick (2013)'s framework for capacity for SWP and incorporating all four of these categories, was used in this research to assess capacity for SWP (Rawlyk & Patrick, 2013; Robins, 2007; 2008). This section will describe these different categories of capacity (which are often overlapping).

Table 2.1. Elements of Capacity for Source Water Protection *

Element	**Definitions and Example Indicators**
Institutional	The legislation, regulations, policies, protocols, governance arrangements and delegation of responsibility to plan and enact SWP. Example indicators include: • Provincial legislation and policies provide guidance for drinking water protection at the local level • Municipal planning strategies and by-laws protect current drinking water supplies • Land use activities are controlled in municipal well field, recharge and watershed water supply areas • Land has been purchased for the protection of current municipal water supplies • Plans have been developed to guide municipal actions during water quality emergencies • All responsible for SWP know their responsibilities for implementation and enforcement • Institutional arrangements for land water management is integrated • Local land use planning supports SWP at a watershed or regional level
Financial	The ability to acquire adequate funds to pay for SWP efforts as well as for ongoing planning, governance and management efforts. Example indicators include: • Organizations responsible for protecting source water supplies are able to maintain a balanced budget • Organizations responsible for protecting source water supplies are able to obtain funding from outside sources • Water rates for customers reflect the full cost of protecting and providing municipal drinking water (including treatment, distribution, maintenance, and SWP) • Funding is available for municipal SWP projects • Financial mechanisms are used to reduce water use (e.g., water rates charged by municipal water utility are used to reduce water consumption)

Social	The social factors that influence SWP governance and implementation. This includes social norms (e.g., values, attitudes, behaviours, sense of place, trust, reciprocity, commitment and motivation) that impact public awareness, stakeholder involvement, community support, and public and private partnerships in SWP efforts. This also incorporates structural networks, communications and the relationships between different groups interests and actors. Example indicators include: • Clear leadership for water quality protection at the watershed level exists • Active linkages between municipality and provincial agencies exist (vertical linkages) • Active linkages among watershed municipalities exist (horizontal linkages) • Active linkages between municipality and community organizations exist (horizontal linkages) • Community awareness and support for watershed protection
Technical/Human	The physical and operational ability of an organization to perform SWP management and operations adequately. In addition, having the human resources, with adequate knowledge, skills and experience to properly create source protection plans and implement needed measures. Example indicators include organizations responsible for protecting source water supplies have: • Employees dedicated to water management • Access to individuals with the necessary skills and training to manage drinking water • Education and training opportunities available to staff members and decision makers • Access to individuals with the expertise needed to undertake technical activities related to drinking water quality • Access to the data needed to manage water supplies, delineate watersheds and aquifers, and develop source protection plans

*Elements and characteristics based on: (Ivey, de Loë, Kreutzwiser, & Ferreyra, 2006; Noble & Basnet, 2015; Rawlyk & Patrick, 2013; Robins, 2008; Timmer, de Loë, & Kreutzwiser, 2007)

Institutional capacity for SWP requires having adequate legislation, regulations, policies, protocols, governance arrangements and delegation of responsibility to plan and enact SWP (Rawlyk & Patrick, 2013). How governance is structured, power dynamics and

participation of all levels of governance (e.g., government, industry, non-governmental organizations) all influence the success of SWP efforts. Capacity building at the local community level should facilitate the integration of water related plans locally and regionally, and the creation of networks that further understandings of catchment issues (Ananda & Proctor, 2013; Brown & Schafft, 2011). Watershed legislation is effective when it is based at the local level, incorporates local knowledge and experience, and is inclusive of the variety of ways watersheds are impacted (Hirokawa, 2011). However, institutional issues can constrain capacity building efforts. For example, using political administrative units rather than natural watershed boundaries with water planning efforts, can pose issues when source water threats cross jurisdictional borders. This is particularly the case when downstream communities cannot control what upstream actors are doing (Medd & Marvin, 2007).

The ability to acquire adequate funds to pay for SWP efforts as well as for ongoing planning, governance, and management efforts is critical for SWP (Rawlyk & Patrick, 2013; Timmer, de Loë, & Kreutzwiser, 2007). Financial capacity requires municipalities to have access to external funding sources and to also have sustainable internal funding frameworks for SWP efforts (Timmer, de Loë, & Kreutzwiser, 2007). Robins (2007) explains capacity in Canada for water management at all levels is lacking due to, "the federal government's failure to show leadership and to invest nationally in watershed management" (Robins, 2007, p. 24). Senior governments such as Provincial governments have a role in providing financial capacity to municipalities with limited financial resources for SWP through the provision of funds for SWP efforts (Timmer, de Loë, &

Kreutzwiser, 2007).

Social capacity for SWP includes social norms (e.g., values, attitudes, behaviours, sense of place, trust, reciprocity, commitment and motivation) that impact public awareness, stakeholder involvement, community support, and public and private partnerships in SWP efforts (Ivey, de Loë, Kreutzwiser, & Ferreyra, 2006; Rawlyk & Patrick, 2013; Robins, 2008). For example, capacity problems can occur when water resource managers hold multiple and sometimes conflicting roles, and vertical and horizontal trust issues impact water management and planning (Ananda & Proctor, 2013). Social capacity also requires having structural networks, communications, and relationships between different watershed actors (Robins, 2008; Timmer, de Loë, & Kreutzwiser, 2007). Learning and understanding amongst different watershed actors is important. For example, education and outreach activities that result in community awareness and support for SWP aid in the successful implementation of SWP policies (Timmer, de Loë, & Kreutzwiser, 2007; Rawlyk & Patrick, 2013).

Human capacity has been included in the technical capacity element which, "refers to the physical and operational ability of an organization to perform source protection adequately" (Rawlyk & Patrick, 2013, p. 24). Though some other authors in the SWP capacity literature (e.g., Timmer, de Loë, & Kreutzwiser, 2007) separate human and technical capacity in their frameworks, the choice was made to adhere to the four elements provided by Rawlyk and Patrick (2013)'s framework and include human capacity within technical capacity. Human capacity was considered part of having the

proper physical and operational ability of an organization to perform SWP effectively (Rawlyk & Patrick, 2013). Including having skilled human resources to undertake SWP and related technical activities as a component of technical capacities, was deemed appropriate for this research, which is focused on capacity for SWP from a largely policy and governance perspective.

Furthermore, regarding technical knowledge for SWP, Ivey et al. (2006) explain,

> Technical knowledge about the particularities of water sources in individual jurisdictions can provide for local decision-making and implementation processes in which the potential negative impacts of land use practices on drinking water can be properly taken into consideration. Technical knowledge can also provide local governments with the necessary legitimacy to engage with senior levels of government, donor agencies and consultants, in the often expert-dominated debate surrounding water quality issues (p. 947).

In order to develop technical knowledge, adequate data is required. This data includes all information needed to manage water supplies, delineate watersheds and aquifers, and develop source protection plans (Rawlyk & Patrick, 2013). As noted, all elements of the capacity framework used in this research is further elaborated on in Table 2.1.

2.4. Source Water Protection and Privately-Serviced Areas

In Canada, individuals served by private drinking water systems may be at greater risk of waterborne illness than those served by municipally operated (i.e. public) drinking water systems (Murphy, Thomas, Schmidt, & Medeiros, 2016). Privately-serviced areas refer to communities where households and public buildings either fully or partially derive their

drinking water from private water systems (e.g. private wells), which fall outside of a municipal drinking water system. Examples of these private systems are household or communal wells or direct surface water connections (usually used for cottages) (O'Connor, 2002b). According to Statistics Canada one-third of rural and small town residents rely on private wells for their drinking water (Hardie & Alasia, 2009). This is a significant part of the Canadian population, with approximately 4.1 million residents (12% of the total Canadian population) relying on private supplies, most of which are in rural areas (Pogoda, Felleiter, & Majury, 2017). Similarly, private wells in Ontario serve a mainly rural population of approximately 1.6 million Ontario residents (Ontario Auditor General, 2016; Simpson, 2004). However, there is a gap in the literature on research regarding private well stewardship in Ontario (Imgrund, Kreutzwiser, & de Loë, 2011), and calls for more work to be done in the mainstreaming of SWP for private wells (Kreutzwiser, de Loë, Imgrund, 2010).

This section will outline SWP tools for privately serviced areas (e.g., policies, regulations, programs, guidelines, etc.), as well as noted challenges and opportunities associated with SWP for these predominantly rural areas. For the purposes of this research, the focus of this section is on SWP for private residential household wells (i.e. non-municipal systems), in the context of Ontario, Canada. This section is rural policy focused and does not address technical aspects of SWP for these areas such as groundwater vulnerability mapping and other groundwater modelling techniques. Furthermore, this section solely concentrates on SWP. However, there are other important means of ensuring clean and safe drinking water for private drinking water systems, such

as and adequate filtration and treatment, that should be recognized (Murphy et al., 2016; Simpson, 2004).

2.4.1. Potential Groundwater Contaminants and Impacts on Human Health

Potential Groundwater Contaminants

Though Canadians who rely on private drinking water wells for drinking water often rate their water quality as high, numerous studies have found these water supplies are at risk of nitrate, bacterial and other contaminants (Jones et al., 2006; Kreutzwiser, de Loë, & Imgrund, 2010). There are both quantity and quality threats to groundwater supplies that source private wells. Some of these threats are outlined in Table 2.2 below. These risks can be mitigated by proper SWP efforts (Kreutzwiser et al., 2011).

Table 2.2. Potential Groundwater Contaminants, Their Properties, Potential Sources, and/or Pathways (Simpson, 2004, p. 1692)

Parameter	**Properties**	**Potential sources/pathways**
Nitrate	• Soluble in water • Tasteless • Colorless • Odorless	• Lawn fertilizers • Septic systems • Surface application of fertilizers, manure, and municipal biosolids • Plowdown legume crops
Pesticides	• May or may not dissolve in water • Tasteless, colorless, and odorless	• Application to fields • Leakage from bulk storage
Solvents	• Do not dissolve in water • May be tasteless, colorless, and odorless • Float or sink	• Leakage from farm vehicles, workshops, and bulk storage • Discharge of hazardous household or farm wastes to septic systems • Some septic system cleaners
Fuels	• Do not dissolve in water • May be tasteless, colorless, and	• Leakage from vehicles, workshops, and bulk storage

	odorless • Float or sink	• Accidental discharge to septic systems
Salt	• Soluble • Salty taste Colorless and odorless	• Surface application for winter de-icing and dust suppression • Naturally occurring

In addition to the above contaminants, climatic conditions can increase the vulnerability of groundwater supplies to contamination. For example, too little precipitation, can impact the quantity of water available. On the other hand, too much precipitation and subsequent flooding can submerge wellheads, allowing surface water to enter (Simpson, 2004)**.** Furthermore, some groundwater supplies are more vulnerable than others due to their geographical location. For example, some areas of eastern Ontario have fractured rock aquifers with low lying rock outcrops that are highly vulnerable to groundwater contamination (Praamsma, 2016). The mixture of thin amounts of rock or soil over the aquifers and fractured rocks can create pathways to groundwater supplies from the surface. This can potentially cause contamination to groundwater supplies from the surface from human activity such as septic systems and agricultural practices (Praamsma, 2016; Wright & Novakowski, 2017). Other ways pathogens can be introduced to private well water include: “fractures in rock, pores in coarse sediments, or macropores (e.g., wormholes) in sediments; improperly constructed or decommissioned wells; and improperly designed, maintained, or sited sewage disposal systems”(Simpson, 2004, p. 1683). Some other notable threats to private drinking water systems include:

> …residential−septic systems and improperly stored or disposed of household hazardous materials and wastes; agricultural−inappropriate storage or application of nutrients, abattoir wastes; municipal−old and active landfill sites; industrial−spilled solvents or

other harmful chemicals (Simpson, 2004, p. 1684).

Unused or improperly decommissioned wells can offer a conduit for contaminants to groundwater supplies (Sustainable Water Well Initiative, 2006)**.** Generally, the risk of contamination of a drinking water well "decreases as the distance between the well and potential contamination sources increases" (Simpson, 2004, p. 1687). Keeping contaminants away from your well's source water supply is important (Rudolph, Barry, & Goss, 1998). Pathogens from septic systems were noted many times in the literature as a particular concern for rural areas, where sometimes numerous septic systems and private wells are located in close proximity (Central Lake Ontario Conservation Authority & Jagger Hims Limited, 2008; Wilcox, Gotkowitz, Bradbury, & Bahr, 2010). Other concerns from potential contaminants that can be located on or near rural residential or businesses properties include: the storage of fuel and other chemicals, winter road deicing, water softener use, fertilizers and pesticides, industrial/commercial chemicals and agricultural land uses (Central Lake Ontario Conservation Authority & Jagger Hims Limited, 2008; Simpson et al., 2007). Diffuse or non-point sources of contamination include: application of animal manure spreading, commercial fertilizers, and insecticides and herbicides to field crops (Rudolph et al., 1998). Point-sources of contamination at the farm scale include: septic fields, manure storage areas, fuel storage, and feedlots (Rudolph et al., 1998). All of the above potential contaminants to private wells pose significant human and environmental health risks. The next section will focus on the human health risks associated with the contamination of drinking water wells (both private and public).

Private Well Contamination and Human Health

There are many ways in which drinking water can impact human health. This is why the above explained multi-barrier approach to drinking water is needed (O'Connor, 2002b; Simpson et al., 2007). Examples of waterborne diseases and illnesses, and responsible pathogens, are outlined in Table 2.3 below.

Table 2.3. Examples of Water-Borne Pathogens and Associated Diseases or Illnesses (Simpson, 2004, p. 1691)

Pathogen	**Disease/illness**
Bacteria • Campylobacter jejuni • Escherichia coli (E. coli) • Salmonella • Shigella	 • Campylobacter enteritis • Gastroenteritis • Salmonellosis • Shigellosis
Protozoans • Giardia lamblia • Cryptosporidium parvum • Entamoeba histolytica	 • Giardiasis • Cryptosporidiosis • Amebiasis
Viruses • Hepatitis A • Norwalk • Rotavirus	 • Hepatitis • Gastroenteritis • Rotaviral enteritis

Individuals relying on private drinking water systems in Canada are certainly not immune to waterborne diseases and illnesses. In Canada, Murphy et al. (2016) found:

> Waterborne illness related to the consumption of contaminated or inadequately treated water is a global public health concern. Although the magnitude of drinking water-related illnesses in developed countries is lower than that observed in developing regions of the world, drinking water is still responsible for a proportion of all cases of acute

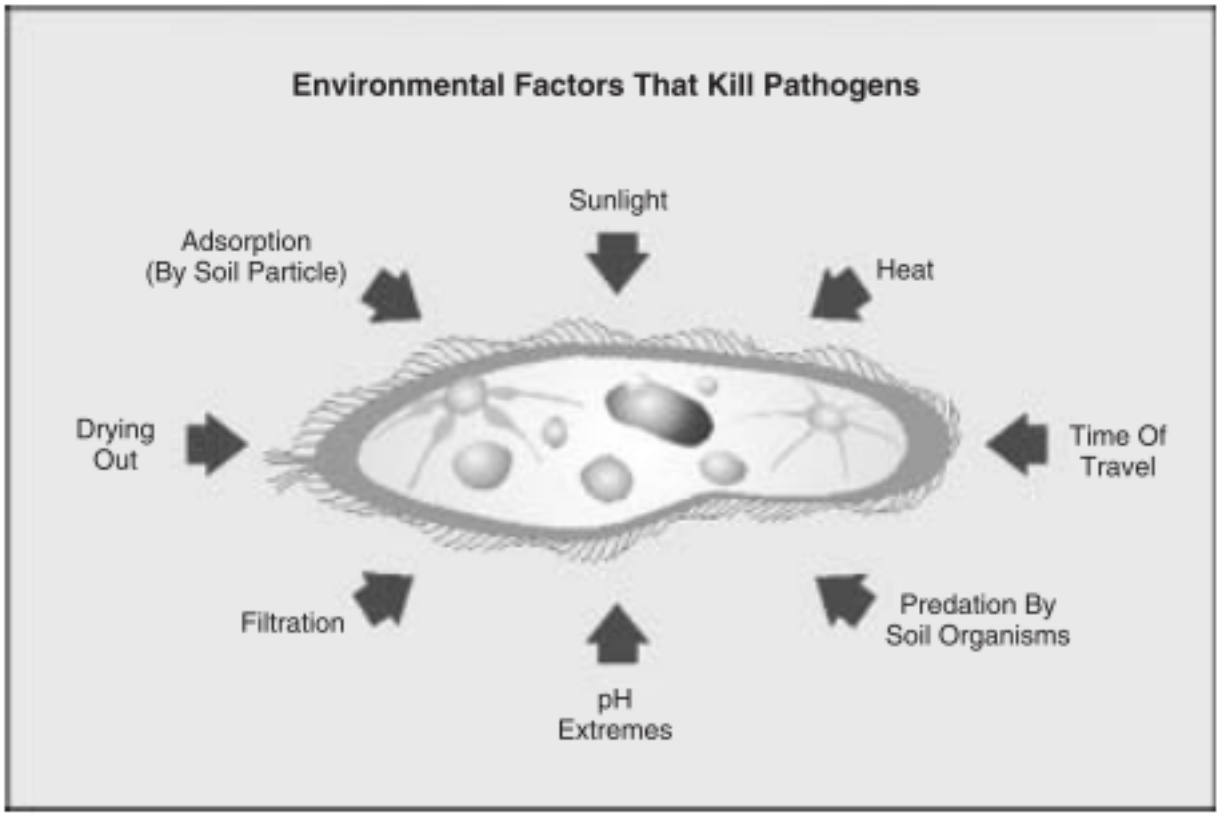
> gastrointestinal illness (AGI) in Canada. The estimated burden of endemic AGI in Canada is 20.5 million cases annually – this estimate accounts for under-reporting and under-diagnosis. About 4 million of these cases are domestically acquired and foodborne, yet the proportion of waterborne cases is unknown. There is evidence that individuals served by private systems and small community systems may be more at risk of waterborne illness than those served by municipal drinking water systems in Canada (Murphy et al., 2016, p. 1355).

The next section will outline examples of technical and planning approaches for SWP in privately serviced rural areas.

2.4.2. Technical and Planning Approaches for Source Water Protection in Privately-Serviced Rural Areas

The literature related to SWP tools to mitigate the contamination of private drinking water wells includes a wide array of natural processes, regulatory controls, and technical approaches, which all require a great deal of education and outreach for those charged to implement these tools (e.g., private well owners, government staff, elected officials, etc.) (Hynds, Misstear, & Gill, 2013; Kreutzwiser et al., 2011; Sarkar, Krishnapillai, & Valcour, 2012; Simpson, 2004; Simpson & de Loë, 2014). Firstly, there are environmental factors that kill pathogens, including the important role soils play in cleansing the infiltrating water (Simpson, 2004; see Figure 2.1). Soil processes for filtering water infiltrating groundwater supplies include: "adsorption−bonding onto soil particles; desiccation−drying out in the unsaturated zone; filtration−by soil particles; predation by soil microorganisms (Simpson, 2004, p. 1683).

Figure 2.1. Environmental Factors That Kill Pathogens (Simpson, 2004, p. 1684)



Technical and planning tools can be used to preserve and aid the natural environmental processes that protect private well supplies, as well as to ensure sustainability of water supplies into the future. These tools also aid in protecting water supplies sourcing nearby municipally operated drinking water systems. This section will summarize five technical and planning tools discussed in the literature that can be used to protect private well supplies: proper construction, maintenance, and decommissioning of wells; septic

inspection programs; watershed planning; private well head protection plans; and voluntary, educational, and outreach programs.

Proper Construction, Maintenance, and Decommissioning of Wells

How a well is constructed, maintained, and subsequently decommissioned at the end of its life can impact the health of groundwater sources as well as the water derived from the well (Simpson, 2004). Unused or improperly abandoned wells are a significant potential source of contamination, and need to be plugged and sealed in order to ensure there is no direct entry to the aquifer of surface water and contaminants or movement of water and potential contaminants between underground aquifers (Simpson, 2004). Construction and decommissioning of wells are regulated in many provinces in Canada. For example, The *Ontario Water Resources Act, 1990, R.S.O. 1990, c. O.40* and its Wells Regulation 903, regulates the construction, use, abandonment, and licensing requirements for wells (Environmental Commissioner of Ontario, 2017). In British Columbia, the Ground Water Protection Regulation establishes standards on how all water wells are to be constructed, maintained, and decommissioned (British Columbia Ministry of Environment, 2005). Similarly, in the United States many state and local policies regulate well construction and location, including regulations on factors such as setback distances, minimum well-casing depths, and protective caps and a grout seal to prevent surface water runoff from entering the well (Wilcox et al., 2010). Having these activities regulated is an important step in ensuring that wells are constructed and decommissioned properly and do not threaten groundwater supplies (Simpson, 2004).

Septic Re-Inspection Programs

An important aspect of protecting rural drinking water is the proper maintenance and stewardship of on-site wastewater systems (i.e. septic systems). Septic systems can pose a significant risk of contaminating private well supplies (Goss & Richards, 2008; Paul, Rigrod, Wingate, & Borsuk, 2015; Praamsma, 2016; Rudolph et al., 1998). Septic systems should be pumped out and r-inspected every three to five years for year round dwellings, and six to eight years for seasonal dwellings (Worron, 2016). Re-inspection programs for residential septic systems are imperative. Worron (2017) explains that a septic re-inspection program provides,

> … quick and inexpensive alternatives to making sure these systems are providing their service while at the same time not harming their surroundings in any way. This will ensure that our protected drinking water zones, freshwater lakes, and other natural resources are kept pristine, while at the same time preventing any harmful events from occurring that may threaten public health (Worron, 2017, p. 87).

Furthermore, a 2006 report entitled the *Sustainable Water Well Initiative* (Prepared for the Ontario Ministry of the Environment) found that to properly protect private wells, septic system pumping and inspection should be mandatory (Sustainable Water Well Initiative, 2006). In Ontario, mandatory septic maintenance inspections are required every 5 years in all areas where septic systems (governed by the *Building Code Act, 1992*), are identified as a significant drinking water threats in source protection plans (created under the *Clean Water Act, 2006, S.O. 2006, c. 22* (CWA)). Onsite inspections are required to be conducted by the principal authority defined by the *Build Code Act, 1992* (e.g.,

municipality, board of health, conservation authority) (Government of Ontario, 2017).

Watershed Planning

Appropriate standards and guidelines are needed for rural areas to protect the groundwater sources that supply private wells, including planning regulations for land use in the entire watershed that contributes to these sources. These standards and guidelines should be compatible with the SWP protection planning efforts for public drinking water supplies (Frind, Rudolph, & Molson, 2001). Unfortunately, there has not been a lot of efforts to consider SWP at the watershed level in order to protect private well supplies. Much of the information available on SWP for private wells relates to maintenance and best practices at the individual land owner level (Caldwell & Landman, 2013; Kreutzwiser et al., 2010; Ontario Ministry of Health and Long-Term Care, 2015; Summers, 2010).

In terms of implementation tools that can be incorporated within such plans, the literature points to zoning and land acquisition as methods to protect the water sources contributing to private well supplies. First, source water supplies contributing to private wells or groupings of private wells need to be determined using geologic and hydrogeologic information. Then protection zones and policies (zoning, by-laws, etc.) can be created to limit risky land use activities to protect the groundwater supplies (Jatel, Curran, Geller, Everdene, & Garcia, 2009). However, the regulatory tools under Ontario's CWA only apply to the protection of public drinking water source water supplies (McClenaghan & Lindgren, 2017). As noted above, regulations resulting from the CWA such as mandatory

septic inspections for septic systems causing a significant threat to municipally operated drinking water systems (Government of Ontario, 2017), can inadvertently also protect private wells. The CWA does provide some protection and opportunities for clusters of private wells to be elevated into source protection plans (Ontario Ministry of Environment, 2006b). Thus far, however, these provisions have not been implemented successfully for a variety of reasons relating to potential financial ramifications, institutional barriers, and a lack of buy-in from residents (McClenaghan & Lindgren, 2017; see Chapter 4).

In Ontario, there are additional regulatory controls that can be used for the protection of watersheds, and within them water supplies and water systems serving privately serviced areas. Many sections of Ontario provincial legislation, such as the *Planning Act,* the *Greenbelt Act*, and the *Oak Ridges Moraine Act*, require municipalities to establish planning controls and bylaws that will provide protection to privately serviced areas (Central Lake Ontario Conservation Authority & Jagger Hims Limited, 2008). Some examples of policies to protect privately serviced source water supplies include:

- Policies providing land use restriction relating to identified vulnerable areas and natural heritage features;
- Policies requiring assessment and monitoring and the implementation of measures to minimize threats to other neighbouring land uses;
- Policies requiring assessment and monitoring associated with the development of new subdivisions serviced by private water supplies;
- Policies or agreements regarding a municipal responsibility agreement to take over operation of private water systems in the event that the owner/operator fails to maintain the service;
- Policies and by-laws that specify the requirements for licenses and inspections

relating to buildings, sewage systems, and in some cases water supplies; and
- Policies and by-laws that regulate, control, or ban the use of pesticides (Central Lake Ontario Conservation Authority & Jagger Hims Limited, 2008, p. 46).

British Columbia's *Groundwater Bylaws Toolkit* outlines some promising examples that could be used by municipalities for private well groundwater protection, including the use of zoning bylaws and development permit areas (Jatel et al., 2009). In Halton, Ontario, an Aquifer Management Plan was instituted to protect aquifers used for diverse purposes in the region. The following areas were targeted in this plan: hydrogeologically sensitive areas, groundwater quantity management, drinking water quality protection, water conservation, well construction and abandonment, contaminated sites, planning for groundwater management, monitoring and performance measurements (Holysh, 1999).

In general, further information is needed to assess risks and plan adequate mitigation measures for watershed based SWP planning for privately-serviced areas. Information needed for SWP planning include a full data base of bacterial testing results and other baseline information on existing wells and the state of water quality and quantity at the watershed level (Krolik et al., 2013; Maier, Krolik, Randhawa, & Majury, 2014; Summers, 2010). This would include the creation of vulnerability maps of groundwater supplies that use a systems theory approach to consider the whole hydrological system that contributes to source water supplies (Balcoch, 2013; Gleeson, Novakowski, & Kyser, 2009). Using this data, risk assessment should be performed for groundwater supplies to determine what regulatory tools would be appropriate for mitigating contamination to private well supplies. This may require an inventory of potential threats and employing

groundwater modeling techniques to establish possible pathways that contaminants could enter groundwater sources (Goss & Richards, 2008). For example, in previous research, flow systems have been simulated through three-dimensional mathematical modeling in order to identify the aquifer system sourcing a grouping of wells (Frind et al., 2001; Holysh & Gerber, 2014). Once the characteristics of the source aquifer are understood, then vulnerability, sensitivity, and risk can be analyzed. Goss and Richard (2008) explain in relation to assessing risk in an agricultural context:

> To confirm that potential pathways are active requires some microbial source tracking. One possibility is to identify the molecular types of *Escherichia coli* present in each hazard on a farm. An essential part of any such index is the identification of mitigation strategies and practices that can reduce the magnitude of the hazard or block open pathway (Goss & Richards, 2008, p. 623).

Context and local conditions vary depending on the characteristics of the watershed contributing to a given aquifer. It is important that SWP policies and planning efforts reflect the specific threats identified for each aquifer (Wilcox et al., 2010).

Another prominent concern for the contamination of private wells is farming practices and the application of nutrients to land (Goss & Richards, 2008; Simpson, 2004). In Ontario, the *Nutrient Management Act, 2002* and O. Reg. 267 regulate the management of the application and storage of nutrients (e.g., manure, animal bedding, materials generated by non-agricultural operations such as sewage biosolids, pulp and paper biosolids and other by-products used in crop growth). O Reg. 267 regulates specific requirements for planning, storage requirements, and land application standards, such as maximum

application of nutrients and setbacks from wells and surface or ground water (University of Guelph Ridgetown Campus, 2017). Creation of Environmental Farm Plans are a key tool in nutrient management, and watershed planning for groundwater protection. In Ontario, Environmental Farm Plans are created by farmers with assistance locally from the Ontario Soil and Crop Improvement Association, in partnership with the Ontario Ministry of Agriculture, Food and Rural Affairs and Agriculture and Agri-Food Canada. The workbook used to create Environmental Farm Plans includes assistance directly related to SWP for private wells including modules on septic systems re- inspection, wellhead protection, and water conservation (Simpson et al., 2007). Simpson (2004) explains, "…the Ontario Environmental Farm Plan is an example of a risk assessment approach that has been used successfully by farmers to evaluate environmental issues associated with their operations and to identify areas of environmental concern" (Simpson, 2004, p. 1701)**.** Evidently, the literature speaks to many land use planning and regulatory activities that can be employed to protect private wells source water supplies on a watershed level.

Private Well Head Protection Plans

In Canada, private water well owners are responsible for providing their own safe drinking water (as opposed to a public operator for municipal systems) (Imgrund, Kreutzwiser, & De Loë, 2011). Protecting groundwater recharge to a private well usually is done at a different scale and plans for doing so include different content from one done for a municipal well (Simpson & Myslik, 2005). Rural landowners often do not have the same technical, financial or land use planning authority to implement SWP for their

private drinking water systems on a watershed level (Simpson et al., 2007). Simpson et al. (2007) explains that a, "private well owner has no authority to control activities on adjacent properties, the activities (e.g. threats) on their own land fall within their direct control" (Simpson et al., 2007, p. 156). In the absence or in addition to municipal controls on a watershed level for the protection of private well source water supplies, landowners can create private wellhead protection plans (PWPP). It is explained,

> With a PWPP, the detailed definition of a private well capture zone may not be necessary in most cases because it may not extend beyond the boundaries of the property on which the well is sited. As a result, the well owner can assume that their property encompasses their capture zone for the purposes of developing a PWPP. This is also a practical approach because it is difficult for a well owner to know with any accuracy where the capture zone lies beneath their property at any one time (Simpson et al., 2007, p. 156).

There are many actions rural landowners can take on their own property to assess potential risks to their source water supplies (Furlanetto, 2017). Resources are available to assist rural landowners in creating their own private well head protection plans to mitigate contaminants (Caldwell & Landman, 2013). For example, in 2017-2018 the Cataraqui Region Conservation Authority in eastern Ontario, Canada will be running well and septic stewardship workshops for the public in collaboration with Ministry of Environment and Climate Change and Public Health Ontario. These workshops will help landowners assess risks to groundwater contamination on their property and to produce a Groundwater Protection Plan for their property (Furlanetto, 2017). Though this is not a regulatory approach, these types of educational and outreach programs are vital for the protection of source water supplies in privately serviced areas.

Voluntary, Educational, and Outreach Programs

Stewardship of private wells, including SWP activities, requires proper education and outreach to residents (Kreutzwiser et al., 2011). Educational programs increase and strengthen awareness and commitment to SWP (Simpson, 2004). Furthermore, a solely regulatory approach for SWP of privately serviced areas does not allow the well owner to understand the purpose for SWP efforts and does not facilitate implementation at the landowner level (Simpson et al., 2007). This landowner level buy-in and involvement is particularly important because institutional capacity to enforce SWP measures is lacking in many rural areas (Eledi et al., 2017). Fact sheets, for example, are provided in Ontario on the need for SWP of private wells and with suggestions for best practices, including advice on what kind of products to use in the vicinity of a well and the importance of keeping a three meter permanent grass buffer around your well (Conservation Ontario, 2007). Factsheets and private water system kits are available to the public at no charge through local public health units and partner ministries such as the Ministry of Environment and Climate Change, the Ministry of Agriculture, Food and Rural Affairs, and the Ministry of Health and Long-Term Care offices (Simpson et al., 2007).

Programs facilitated by regional actors such as Conservation Authorities can also be key in increasing educational efforts. However, municipalities need assistance in areas where no such actors exist (Eledi et al., 2017). Murphy et al. (2016) urge that the stewardship of private wells should be a shared responsibility between private well owners and governments at all levels (Murphy et al., 2016).

The following steps outline ways to increase awareness and understanding of SWP for private wells:

- Help the community understand the need to protect groundwater resources.
- Create an alert and informed community that may be helpful in promoting protection programs among neighbors.
- Encourage the community to implement voluntary remedial measures, such as reducing the risk of land use practices (i.e., upgrade the construction of water supply wells). (Simpson, 2004, p. 1698)**.**

Ultimately, increasing the knowledge and awareness of landowners and the general public on SWP issues increases the attention given to and social support for land use controls (Simpson, 2004)**.** However, there are challenges in the implementation of SWP programs in privately serviced areas.

2.4.3. Challenges for Source Water Protection in Privately-Serviced Rural Areas

Management of water resources is commonly considered a "wicked problem", since it is, "often embedded in seemingly endless ecological, social and political interactions across temporal and spatial scales, are context-dependent, socially constructed and technically uncertain" (Ferreyra et al., 2008, pp. 304‑305). These types of wide ranging challenges exist for the protection of source waters suppling private wells. In this section five prominent challenges outlined in the literature will be discussed: regulatory gaps; lack of water quality data and effective vulnerability mapping; costs to landowners; and effective public engagement.

Regulatory Gaps

Historically, a significant amount of drinking water associated waterborne illness outbreaks and contamination events have been attributed to unregulated water systems (such as private wells) (Balcoch, 2013). Regulations for private wells have been found to be weak or poorly enforced in Ontario (Kreutzwiser et al., 2011). As noted, the *Ontario Water Resources Act, 1990, R.S.O. 1990, c. O.40* and associated Wells Regulation 903 regulates the construction, use, abandonment, and licensing requirements for wells (Environmental Commissioner of Ontario, 2017). However, regulations are only enforceable at point of installation, meaning after the well is installed there are no regulatory controls to ensure proper stewardship (McClenaghan & Lindgren, 2017). Furthermore, the *Clean Water Act, 2006* (CWA) in Ontario has been criticized for providing little protection for private well supplies. McClenaghan and Lindgren (2017) explain:

> …the numerous Ontarians who depend upon non-municipal systems for drinking water purposes generally lack the legal protection conferred under the CWA (although private well owners fortunate enough to be located within municipal Wellhead Protection Areas may derive some indirect protection under approved Source Protection Plans) (McClenaghan & Lindgren, 2017, p. 6).

Source protection plans made under Ontario's *Clean Water Act, 2006* were further criticized by the Ontario Auditor General for not protecting the estimated 1.6 million Ontarians who derive their drinking water from private wells, and for not addressing risks posed by abandoned wells to groundwater sources (Ontario Auditor General, 2016). There are an estimated 730,000 abandoned wells in Ontario, and it is unknown how many

of these have been decommissioned properly (Ontario Auditor General, 2016). The *Nutrient Management Act*, *2002*, further legislation designed to protect groundwater supplies, was also criticized by the Ontario Auditor General in 2016 for weak enforcement (Ontario Auditor General, 2016).

In regard to SWP for private well supplies, the Ontario General recommended the following:

- Considering the feasibility of requiring SWP plans to address threats to sources of water that supply private wells;
- Phasing in remaining farms in Ontario that generate or apply nutrients so that they also must adhere to the requirements of the Nutrient Management Act; and
- Updating the Ministry's water-taking charges to improve cost recovery (Ontario Auditor General, 2016, p. 158).

There are currently not the same enforceable mechanisms in place for the protection of private drinking water supplies, as there is for the protection of public drinking water systems (McClenaghan & Lindgren, 2017). These regulatory and enforcement gaps pose a potential vulnerability to privately serviced areas. It was found in 2013 that,

> …over a third of the water samples from private wells tested positive for bacteria including E. coli. If private wells were held to the same safety standard used for public drinking water systems, water from these wells that tested positive for bacteria would be considered unsafe to drink (Ontario Auditor General, 2014, p. 411).

Furthermore, private water supplies do not have the same amount of water quality data as municipal systems do. Water quality data is key in assessing risks and needed regulatory

approaches to protect drinking water sources (Rudolph et al., 1998).

Lack of Water Quality Data and Effective Vulnerability Mapping

Many of the approaches for SWP for privately serviced areas require assessment of risks to water supplies and delineation of capture zones to properly plan for said risks (Balcoch, 2013; Frind et al., 2001; Goss & Richards, 2008; McClenaghan & Lindgren, 2017; Richards, Miller, & Green, 2013). In contrast to public drinking water systems in more urban areas,

> the rural population depends almost entirely on groundwater, but rarely has access to historical water quality data. The individual users are generally responsible for their own quality monitoring. As a result, the condition of much of the rural groundwater resource is not well documented (Rudolph et al., 1998, p. 296).

Furthermore, in a report prepared for the Ontario Ministry of Environment and Climate Change on including other systems into the *Clean Water Act, 2006* (such as those in privately serviced areas), it states "in order to improve the ability of municipalities to use this system it will be important to improve access to the datasets necessary to conduct the analysis" (Central Lake Ontario Conservation Authority & Jagger Hims Limited, 2008, p. vi).

However, current tools and modeling techniques available for analyzing privately serviced systems are still being developed (Richards et al., 2013). For example, depending on the different geography of some groundwater areas, some tools may be less

effective. For example, in eastern Ontario, “tools available for groundwater vulnerability mapping are not effective in fractured rock terrains with low lying rock outcrops” (Praamsma, 2016, p. 131). However, there have been pilot studies in ‘near’ northern Ontario, where groundwater source protection methodologies were applied to clusters of wells in privately serviced hamlet communities. Hydrogeological mapping was conducted for five communities in order to delineate wellhead protection zones. Information used included water well records, geological mapping, groundwater contouring methods, and time of travel assessments. This pilot study resulted in further information about source areas that could be used in community planning for these towns (Richards et al., 2013). Lessons from this study urge the inclusion of detailed door to door surveys regarding groundwater usage in order to complement any definitions of wellhead protection zones delineated by technical models. The research also calls for a formal definition through the CWA legislation of what exactly comprises a well cluster (Richards et al., 2013, pp. 7-8). Lastly Richard et al. (2013) explain,

> although the application of the Technical Rules to the well cluster settings require only the definition of WHPA-A and WHPA-B zones around the clustered well communities, the extension of the methodology used in this study to include the 25 year WHPA-D zone was considered to be a valuable enhancement to the overall study program. It is recommended that the WHPA-D zone be included in any future well cluster assessments (Richards et al., 2013, p. 8).

There is evidence that assessing risk on an aquifer level effectively in privately serviced areas is still a work in progress. Nevertheless, collecting as much information as possible on the characteristics of the source water supplies for privately serviced areas has been found to be beneficial for source protection planning for these areas. However,

assessment of vulnerabilities or risks requires costs to landowners to undertake best management practices (Simpson et al., 2007). In the next section the issue of costs to landowners for SWP efforts in privately serviced areas is discussed.

Costs to Landowners

Costs associated with SWP efforts to landowners can be a barrier for the implementation of best practices (Simpson et al., 2007). Simpson et al. (2007) outline that rural water quality programs are beneficial when the recommended best management practices (BMPs) "can achieve water quality goals without resulting in a net cost to the land owner. This is particularly relevant with water well maintenance and decommissioning where the recommended BMPs may provide little or no obvious financial benefit" (Simpson et al., 2007, p. 159).

To assist in achieving this aim of no net cost to the landowner, for example, the Grand River Conservation Authority's Rural Water Quality Program provides cost-share grants and incentives to farmers to help them implement activities that will improve rural water quality in the region (Simpson & de Loë, 2014). In the first 15 years of operation, the Program, "provided grants of approximately $7 million, and landowners have contributed more than $14 million, to implement more than 2190 projects" (Simpson & de Loë, 2014, p. 232). Similarly, there are incentives in Ontario for farmers through The Canada-Ontario Farm Stewardship Program. This program is a voluntary cost-share program to help farmers adopt best management practices identified in their Environmental Farm Plans. Cost-share for specific categories include a 30-50 per cent ratio (Simpson et al.,

2007).

As discussed above, septic systems can pose a threat to private wells. Inspection of septic systems costs a landowners approximately $250, and pump-outs of septic tanks can be up to $600 depending on the state of the system and the leaching bed (Worron, 2016). Regardless whether it is a mandatory or a voluntary maintenance program, the implementation of these programs can be costly. Furthermore, if problems are found and systems need to be repaired or replaced, this can be a significant cost to the landowner. In Ontario there are funds available for these efforts, though eligibility for support often depends on being located in certain designated areas (e.g., areas of concern under the *Clean Water Act, 2006*) (Worron, 2016).

Given the potential costs to landowners for SWP measures in privately serviced areas, there has to be a significant buy in from landowners to ensure effective SWP. It is important to have SWP programs that provide private landowners funding to implement best management practices, as well as the educational support that allows them to understand the importance of adopting these practices (Simpson et al., 2007). The next section outlines challenges associated with a lack of awareness of the need for SWP, as well as methods for alleviating these challenges.

Effective Public Engagement

Given the legislative gaps for private well protection, actions taken by the landowner are very important (Kreutzwiser et al., 2011). However, because there are financial costs to

landowners to implementing SWP efforts for private wells (Simpson et al., 2007), these actions will not likely be taken, especially since most actions are voluntarily their responsibility and not regulated (Kreutzwiser et al., 2011). Efforts can be taken, however, to increase the likelihood of landowner support and adoption.

Studies have shown that engaging private well owners to conduct stewardship requires more than mass-media campaigns (Renaud, Gagnon, Michaud, & Boivin, 2011). These efforts need to be,

> combined with more personalized interventions that take behavioral determinants and local actor involvement into account, the campaigns might potentially provoke behavioral changes for which control depends on the individual. This study also demonstrates that individual health decisions need to be supported by enabling and reinforcing factors to help well owners to take action for their own health (Renaud et al., 2011, p. 474).

There is a need to link SWP efforts to human health, as safe and clean water is vital to human health (Murphy et al., 2016). Further to this, the risk contamination of private wells is not always well understood. It was found,

> …the magnitude and sources of waterborne (enteric) illness in Canada are not well-defined. Enteric illness is largely under-reported, and existing national and provincial surveillance systems for enteric illness do not distinguish between infections caused by food, animal contact, person-to-person, environmental, or drinking water transmission…In a review of Canadian waterborne outbreaks between 1974 and 2001, two-thirds of the outbreaks occurred at either private or semi-private systems (Murphy et al., 2016, p. 1356).

Previous research has shown that effective engagement of home-owners in private well stewardship in Newfoundland and Labrador, Ontario and across Canada is negatively

impacted by complacency, inconvenience, cost, privacy concerns, and ignorance (Kreutzwiser et al., 2011; Murphy et al., 2016). Furthermore, some transient rural populations such as second home owners from urban areas may not be aware that their tap water is derived from a private well supply (Simpson et al., 2007). It is imperative that private well owners are educated on the specifics of their particular well and surrounding area in order to properly evaluate source water threats and properly enact SWP efforts (Simpson, 2004).

Simpson & de Loë (2014) reinforce the need to involve landowners and the general public in all SWP planning, and that SWP educational and outreach programs can be a way to share risk perceptions and engage citizens (Simpson & de Loë, 2014, p. 229). It was found to encourage stewardship of private wells, "local initiatives, better educational materials, and enforcement through real estate laws are all required" (Kreutzwiser et al., 2011, p. 1104). Effective public engagement of domestic well owners is of the utmost importance (Summers, 2010; Sustainable Water Well Initiative, 2006). It is essential to get communities involved in managing activities on their land and to understand factors influencing private well stewardship behaviours (Kreutzwiser, de Loë, & Imgrund, 2010). For example, surveys can be used to gauge current stewardship practices and the current levels of knowledge of residents. Educational and outreach events subsequently can be tailored specifically to knowledge gaps in the area of concern (Imgrund et al., 2011). In addition, before consultation and educational sessions begin, there should be procedures in place to address inevitable concerns and potential conflicts with the subject matter (Kreutzwiser & de Loë, 2002).

There is need for further data on water supplies in privately serviced areas, as noted above (Richards et al., 2013). To properly engage the public, better data sets on both environmental health and human health consequences of potential vulnerabilities to these private well supplies is needed (Murphy et al., 2016). However, there is also a need to provide the technical capacity for residents to understand the implications of this data. Potential threats and vulnerabilities were found in a case study in eastern Ontario on privately serviced areas source supplies, for example (Kozuskanich, Novakowski, Anderson, Crowe, & Balakrishnan, 2014). The study ignited panic amongst the case study community's residents as well as confusion on the state of their source water supplies (Schliesmann, 2014; Township of Rideau Lakes, 2014). This study highlights the challenge of conducting technical groundwater research and properly communicating findings to residents.

Other key findings from a survey distributed to residents in Alberta regarding well stewardship found that there is still room for improvement in the Canadian context in this area:

- Survey respondents demonstrated a low level of participation in well maintenance and stewardship practices…
- Most respondents demonstrated a low level of knowledge with regards to the source of their well water and the functioning of their well…
- Most survey respondents have a false sense of security regarding the risks posed by their well and unjustified confidence in their knowledge of their water supplies…
- Awareness of well stewardship practices was not sufficient to motivate many

survey respondents…
- Health and aesthetic concerns and a desire to follow good practice were key motivators for engaging in water well stewardship practices…
- Financial costs are not a significant barrier in undertaking well stewardship practices…
- Many respondents indicated the need for more information on how to undertake proper well stewardship practices…
- Respondents indicated that they would likely seek information from a number of sources if they had questions about their water well (Summers, 2010, pp. iv–v).

Increasing financial capacity in rural communities is not always an option, and financial costs are not always a significant barrier in undertaking stewardship practices (Summer, 2010). However, creating effective and implementable policies that meet the needs and goals of all stakeholders, including the general public, in a cost efficient manner has been a problem for planners and activists in watershed planning (Webler & Tuler, 2001). Engaging the public in watershed planning, governance, and management has been proven to get local level actors better involved in the management of their water, thus increasing the technical/human and social capacity involved in watershed management efforts (de Loë & Kreutzwiser, 2005; Robins, 2007). Furthermore, others have found that engaging the public in water management is an essential part of both governing and managing water systems (Conrad & Daoust, 2008; Hamstead, Baldwin, & Keefe, 2008; Hardy & Koontz, 2008; Özerol & Newig, 2008; Rouillard, Benson, & Gain, 2014; Sharpe & Conrad, 2006). Education and outreach are essential activities whether water supplies are being protected on the watershed, aquifer, or wellhead level (Kreutzwiser et al., 2011; Simpson, 2004; Simpson et al., 2007).

2.5. Collaborative Watershed Governance

Governance has become common practice in the governing process of democratic societies (Ansell & Gash, 2008). Governance studies are increasingly interdisciplinary, drawing from disciplines such as political science, geography, economics, sociology, and environmental studies (Gibson, 2018). In contrast to management, which refers to the day-to-day technical actions taken on what is being governed (Cohen, 2012) governance refers to a wide range of structures, institutions, processes, and activities, both formal and informal (Gibson, 2018). As traditional top-down governmental governing has seen failures in practice, governance in recent decades (sometimes referred to as new governance) has been used as a 'catch all' phrase where civil society is empowered to be part of the governing process (Kooiman, Bavinck, Chuenpagdee, Mahon, & Pullin, 2008; Rhodes, 1996; Welch, 2002). In comparison to government, governance used in this way is more bottom-up and horizontal in structure. Governance can occur at different scales (e.g., national, international, local, or the industry level), and is seen as important when governing actors at multiple scales. Collaborative governance includes government actors, multilateral institutions, NGOs, business, academics in public private partnerships, and networks that produce and coordinate policy decisions (Bulkeley, 2005; Bogason & Zølner, 2007; Gibson, 2018).

Several authors argue that governance is an ambiguous term with no single definition (Bevir, 2011; Jessop, 1995; Jordan, 2008). Though governance has many definitions a common element is the involvement of formal and informal networks or collective efforts of various actors including: government, private business, civic organizations,

communities, political parties, universities, the media and the general public (Crosby & Bryson, 2010; Jentoft & Chuenpagdee, 2009; Rhodes, 1996). Despite this diversity in strucutures and actors involved, governance systems can also have a degree of centralization and include vertical coordination (Pahl-Wostl, Becker, Knieper, & Sendzimir, 2013). Stoker (1998) describes governance as having five pillars:

- A set of institutions and actors that are drawn from but also beyond government;
- Identifies the blurring of boundaries and responsibilities for tackling social and economic issues;
- Identifies the power dependence involved in the relationships between institutions involved in collective action;
- Is about autonomous self-governing networks of actors; and
- Recognizes the capacity to get things done, which does not rest on the power of government to command or use its authority. It sees government as able to use new tools and techniques to steer and guide (Stoker, 1998, p. 18).

Governance using these pillars (and other governance concepts) have become increasingly prevalent for the planning and management of watersheds (Bidwell & Ryan, 2006; Parkes et al., 2010; Vodden, 2015).

Governance structures along watersheds have existed for centuries. However, in recent decades there has been more emphasis put on this practice for several reasons, including the re-scaling to the local level of water responsibilities in the context of neoliberalism (Cohen, 2012), the normative understanding that democracy requires societal participation (Kooiman et al., 2008) and the growing realization of the interrelationships between governance, water, and social networks (Norman, Bakker, & Cook, 2012). Scale is important and complicated in watershed governance, as watersheds are often nested

within other watersheds, and intersect with other political and social boundaries. Watershed issues cross political and jurisdictional borders and "…political boundaries have become framed as an obstacle to be overcome in efforts to carry out more participatory and ecologically meaningful forms of governance" (Cohen, 2012, p. 2210). New watershed based governance strategies that are decentralized, participatory, include diverse actors, and use consensus based problem solving in conjunction with traditional bureaucratic institutions are needed (Allan, Curtis, Stankey, & Shindler, 2008; Bidwell & Ryan, 2006; Cohen, 2012; Reed & Bruyneel, 2010) Many of these changes in watershed governance require shifts in the legislative, policy and regulatory environment (Moriarty, Smits, Butterworth, & Franceys, 2013).

Collaborative governance specifically was chosen to be used as a framework in this research as it pertains to watershed governance (aka collaborative watershed governance). This was chosen because the source protection committees under the CWA engages multiple actors in the decision-making process and relies on public consultation at the local level during the planning process (Ontario Ministry of the Environment and Climate Change, 2017). This process suggests a collaborative governance approach which typically includes multi-level governance structures and may therefore be referred to as multi-level collaborative governance (Gibson, 2018). Collaborative governance brings together public and private stakeholders in collective forums to engage in consensus-oriented decision making (Ansell & Gash, 2008). Collaborative governance arrangements should catalyze action and improve upon government or agency resources (Rogers & Weber, 2010). This new governance paradigm has a vital role for non-government actors

(from profit and not-for-profit organizations), and citizens, and is driven by collaboration as opposed to government authority (Vodden, 2015).

To have success in collaborative governance the literature suggests that a range of factors must be present. These include:

- Face-to face dialogue;
- Leadership;
- Trust building;
- Development of commitment;
- Shared understanding;
- Shared motivation and realization of interdependence;
- Capacity for joint action;
- Respect of diversity of values and perspectives;
- A learning environment including mutual learning;
- Shared power;
- Mutual accountability;
- A multi-faceted managerial strategy; and
- Application of a systematic fiscal strategy (Ansell & Gash, 2008; Emerson et al., 2012; Himmelman, 2002; Rogers & Weber, 2010; Vodden, 2015; Weber, 2012).

Further factors influencing the success of collaborative watershed governance include:

- History of conflict or cooperation;
- Incentives for stakeholders to participate;
- Power and resources imbalances;
- Institutional design and character of the organization;
- Property right issues;
- Information gaps;
- Norms of agency authority; and
- Administrative inflexibility (Ananda & Proctor, 2013; Ansell & Gash, 2008; Emerson et al., 2012; Vodden, 2015; Weber, 2012).

2.5.1. Challenges with Collaborative Watershed Governance

The literature outlines a great many challenges with collaborative watershed governance in both theory and practice. Some authors believe that more open governance styles are

not always necessary for water management and that the appropriate form of governance depends on what aspect of water systems is being governed (Vreugdenhil, Slinger, Thissen, & Rault, 2010). Also, with concepts such as Integrated Watershed Management there has been much debate about the effectiveness and difficulty associated with the polycentric governance structures required in this approach (Blomquist & Schlager, 2005). This section examines five prominent watershed governance challenges in the literature: transaction costs; institutional capacity; scale and inclusion; uncertainty, complexity, and transferability; and monitoring and evaluation.

Transaction Costs

Collaborative watershed governance takes a great deal of time, expertise, and often financial support (Ananda & Proctor, 2013; Ansell & Gash, 2008; Medema et al., 2008). In earlier conceptions on collaboration and microeconomic theory, it was thought that individuals are motivated to collaborate to maximize efficiency and reduce transaction costs (i.e. the cost of participating) (Wood & Gray, 1991). In practice, watershed governance has been found to have many transaction costs (e.g., the time or money it may take to be involved), which become great deterrents for collaboration. Watershed partnerships are more likely to be successful if benefits outweigh transaction costs. Some features that can influence the severity of transaction costs are institutional support; characteristics of actors (income, education, race); and watershed area (potential level of control) (Lubell, Schneider, Scholz, & Mete, 2002). Some factors affecting real and perceived benefits of collaborations include: perception of problem severity, institutional opportunities, political incentives, and ensuring equity and efficiency for who pays for

reform measures (Lubell, 2004; Lubell et al., 2002). To reduce transaction costs of collaborative watershed governance Memon and Weber (2010) suggest the establishment of formal binding collective choice rules for the collaboration. These agreements outline consensus on power sharing and incentives that recognize the costs of participating. Furthermore, innovative, cost-effective and long-term evaluations of the governance structure and outcomes are needed so that participants do not feel that their time or money has been wasted (Medema et al., 2008).

Institutional Capacity

Though there are several types of capacity prominent in the watershed governance literature (e.g., social, financial, etc.) the challenge of institutional capacity, discussed in Section 2.3 above, is discussed widely. Healey (1998) states that institutional capacity requires place-focused stakeholders to improve their power to make a difference. Institutional capacity includes considerations of governance structures as well as the institutional power of the watershed governance structure to implement decisions (Norman, Bakker, & Dunn, 2011; Robins, 2007). In watershed governance, despite the neoliberalization of governance and resulting transfer of responsibilities to other often lower levels of government and non-government actors, senior level government still have a role to play in protecting water sources (Cohen, 2012). For example, when examining the Canada-United States of America water governance challenges in managing the Great Lakes, rescaling of water governance did increase the number of local actors involved. However, the addition of more local actors in the governance process did not increase local institutional capacity; nor did it dilute the power of the state

(Norman & Bakker, 2009; Reed & Bruyneel, 2010).

Solving institutional capacity issues for watershed governance is difficult. It requires multi-level governance, as well as support and willingness from all levels of government (particularly senior levels) to share power to establish priorities, make decisions, and generate and distribute resources (Robins, 2007; Vodden, 2015). To enhance institutional capacity for implementation, collective learning mechanisms such as monitoring, evaluation and reflection (discussed further below) are needed to ensure shared accountability (Vodden, 2015). This requires ways to facilitate societal learning for broad social consensus to take place (Pahl-Wostl et al., 2011). An intermediary organization (such as conservation authorities or non-governmental organizations) can play a role in improving institutional capacity in the governance process. These intermediary organizations act as a go-between and facilitator that assist in the societal learning process by translating sustainable water practices and technologies from strategic concerns into local contexts (Marvin & Medd, 2007). Plummer and Armitage (2007) suggest that adaptive institutional capacity be employed where the governance structure has the ability to evolve and change in response to new information and issues.

Scale and Inclusion

As outlined above watersheds are difficult to govern due to issues of scale, which also leads to further issues of inclusion. Blomquist and Schlager (2005) outline in their paper on the pitfalls of IWM that watersheds are hard to define. Often the determination of which communities to include in watershed governance cannot be resolved with a

topographical or political map. When using hydrologic scales conflicts occur, whether on a multi-national level, regional or local level (Schneider, 2010; Sneddon, Harris, Dimitrov, & Özesmi, 2002). There is a need to recognize not only the hydrological processes that shape watershed boundaries and subsequent conflict but also the social processes that contribute to ecological degradation. Only then can one identify context specific ways to understand and govern these socio-ecological systems (Sneddon et al., 2002).

Once a watershed is defined for governance purposes, then who to involve in the decision-making process can pose an even bigger problem. In polycentric arrangements there are many actors who are non-local that may have a vested interest in the watershed (e.g., industry, tourists, environmental groups). However, opening decision making to non-locals has proved to cause problems (Blomquist & Schlager, 2005). Jentoft (2007) suggests stakeholders can be determined by looking at individuals and groups that have something to win or lose in the governing process, but this approach could lead to an unmanageable number of people identified as stakeholders. Therefore, stakeholders often must be ranked according to urgency of their concerns, legitimacy of their interests or the power they hold (Jentoft, 2007). For example, Indigenous peoples must always be included in the watershed governance process not only because Indigenous peoples are important watershed actors, but also for democratic legitimacy, effective problem defining, and policy implementation (Memon & Weber, 2010). In the example of the Long Tom Watershed Council in Oregon, United States of America, it was found that on the actual council not every single stakeholder needed to be included in the decision-

making process. Instead, the council encouraged all stakeholders to become involved in the watershed through projects and events (Collay, 2010; Flitcroft, Dedrick, Smith, Thieman, & Bolte, 2010; Flitcroft, Dedrick, Smith, Thieman, & Bolte, 2009).

Power dynamics of stakeholders is also an important consideration in watershed governance (Saravanan, Mcdonald, & Mollinga, 2009). To address potential issues with power, at the outright of the collaboration stakeholders need to adopt a series of formal and informal rules (e.g., shared power, a formal contract, incentives that recognize costs) in order to regularize the behavior of more powerful stakeholders. This also enhances trust and accountability in the process (Memon & Weber, 2010). Scale is again important for eliciting trust in watershed organizations. In the Long Tom Watershed example, generally, stakeholders and governance/management groups had better relationships when governing at a smaller scale. The importance of both the hydrological and human dimensions (relationships) in watershed governance for the Long Tom Watershed proved to be essential for combatting environmental degradation (Collay, 2010; R. Flitcroft et al., 2010).

Uncertainty, Complexity, and Transferability

One of the majors criticisms in the literature of collaborative watershed governance is that particular models are not easily transferable from one context to another, and there is no agreed upon panacea on how to achieve related goals such as integrated watershed management (Blomquist & Schlager, 2005; Emerson et al., 2012; Jentoft, 2007). Further, watersheds may be too diverse, complex, uncertain, fragmented, dynamic and vulnerable

to be fully controlled by a governing system (Booher & Innes, 2010; Jentoft, 2007; Jentoft & Chuenpagdee, 2009; Memon & Weber, 2010). Sometimes watershed governance does not work and you have to re-assess and re-structure through situational-specific analysis (Saravanan et al., 2009). In addition, what works in one watershed may not work in another.

The governability assessment framework is one tool for addressing these concerns as it enables governors (including researchers) to identify what is working/not working in governance (Jentoft & Chuenpagdee, 2009). However, this type of adaptive governance strategy can take a great deal of time, requires a long-term commitment to the process, and can be financially costly, which does not make stakeholders feel safe or have trust in the process (Jentoft, 2007). Allan et al. (2008) asked if adaptive approaches to watershed governance and management are simply too hard for humans? In response to this question, the literature does support the need for empirical testing, and more long term comparative governance case studies in order to understand the potential contributions and transferability of watershed governance structures as well as lessons to be learned (Jordan, 2008; Pahl-Wostl et al., 2011; Vodden, 2015).

Monitoring and Evaluation

As seen with the above four challenges, there is a noted lack of monitoring and evaluation of governance inputs, processes and outputs. Thomas (2008) states that existing literature on collaborative inputs and process is more explanatory than evaluative. This lack of evaluation leads to issues with the generalizability of research findings and also limits

trust in governance systems. Evaluations of collaborative governance arrangements are often incomplete, and require better ways of acknowledging diverse public values in a process that encourages societal learning (Rogers & Weber, 2010). Some factors to consider for monitoring and evaluation of governance processes, inputs and outputs include:

- Social and political capital;
- Agreed-on information and shared understandings;
- High quality agreements;
- Cost-effective decision making;
- Learning and change beyond the original group;
- Innovation;
- Cascade of changes in attitudes, behaviors, and actions; and
- Institutions and practices that involve flexibility and networks (Connick & Innes, 2001).

Despite acknowledgement of the complexity of watersheds, goals need to be narrowly defined during watershed governance processes in order to aid in collaborative efficiencies as well as the evaluation of the achievement of said goals (Allan et al., 2008). Evaluation includes the creation of standardized assessment and monitoring processes, integration of data, and the creation of better monitoring tools with expanded scopes of time (Norman et al., 2011).

In order to assess collaborative watershed governance in this research Table 2.4 was created outlining 11 key elements of collaborative watershed governance identified in the literature, as well as indicators of each element.

Table 2.4**.** Elements of Collaborative Watershed Governance*

Element	**Example Indicators**

Legislated process/organized structure	• Formalized rights, responsibilities, and rules. • Actors/stakeholders feel that having the process legislated was beneficial. • Clear missions, mandates, and/or objectives. • Missions and objectives remain constant throughout the planning and implementation process. • High quality agreements/partnership agreements created from the collaboration. • A clear framework for data collection. • New norms created for interaction and business conduct, including communication protocols and the creation of a terms of reference.
Integration	• Coordination among different policy tools at different scales. • Integration with all other necessary actors. • Land and water management policies developed in collaboration. • Consideration of multiple policy goals, that address economic, social and environmental values.
Right actors at the table	• All relevant stakeholders who are needed at the table to make appropriate decisions are represented. • Recognition of the legitimacy of diverse stakeholders and decision-makers. • Incentives for stakeholders to participate. • The acknowledgement that all actors at the table were beneficial to the planning process. • Selection of stakeholders is done in a fair and equitable manner.
Shared ownership and accountability	• All policies are legitimate (genuine approval of institutions or actors subject to policy implementation). • High quality agreements have been made. • Development of commitment to and acknowledgement of responsibility in implementation by all necessary actors. • There is an agency or group of agencies with a leadership role in the assessment and monitoring of implementation. • There is an agency or group of agencies with authority to implement and/or enforce regulations. • Stakeholders hold each other and decision makers accountable for decisions and commitments made. • There is an inter municipal agreement to enact policies. • Watershed residents and organizations champion the plan with ongoing dedication to its successful implementation.
Knowledge sharing and learning	• There is a shared understanding of watershed characteristics. • Creation of a learning environment (e.g., spaces/forums that encourage learning) where there is open flows of

	communication, dialogue, and mutual learning amongst participants. • Recognition and consideration given to different ways of knowing and interpreting the environment. • A sense that the planning process fostered mutual learning between stakeholders and decision makers. • Learning and change beyond decision makers. • Room for innovation and context specific flexibility in process. • Changes in attitudes, behaviours, and actions amongst the greater watershed. • The acknowledgement that participants must engage in a process of self, social, and organizational learning in order to participate effectively in governance. • Different types of learning were effectively facilitated.
Public participation	• Public participation opportunities should incorporate best practices such as: timely engagement; information flows both ways through collaborative dialogue; educational opportunities; transparency of process; equity; empowering policies and incentives; context appropriate engagement methods; engagement of public is inclusive and accessible; issue is linked to socially relevant topics; public representation at the decision making table; opportunities for feedback throughout the process; and ways for the public to be involved in evaluation and monitoring. • Public has the ability to influence decisions. • Financial and technical support for implementation to the public, so that they know and understand their responsibilities and roles in implementation.
Trust building and transparency	• Transparency in the planning, governance, and implementation process. • Feeling of trust and respect to speak freely during planning and decision-making processes. • Understanding of other stakeholders' roles. • Increased communication with watershed stakeholders as a result of the collaboration. • The fostering of public trust in the collaboration and outcomes (e.g., plans, policies, etc). • Local communities are engaged in watershed planning, monitoring, environmental assessment and related decision-making processes. • Agreed-on information and shared understanding of issues. • There is willingness amongst authorities to share data and to coordinate activities related to the watershed plan.

	• Trust in decision-makers to create appropriate and effective policies. • Trust that all stakeholders will implement necessary responsibilities resulting from the collaboration.
Fairness	• All stakeholders hold equal advantages and power within the decision-making process. • Negotiations and decisions are based on consensus. • Adequate time for the public and municipalities to review plans. • Policies fair for rural and urban areas. • Appropriate ways in place for solving disagreements/conflict. • Balance of power and resources. • An overall inclusive process.
Adequate resources and capacity	• Local communities are engaged in watershed planning, monitoring, environmental assessment and related decision-making processes. • Application of a systematic fiscal strategy to fund the collaboration and outcomes (plans, policy implementation, etc). • Adequate amount of money, expertise, technical information, leadership, external connections, social capital, and institutional power to properly make governing decisions and implement said decisions. • Capacity building is part of the collaboration.
Common benefit evident	• Shared motivations and realization of interdependence in the collaboration. • Decision-makers and other stakeholders believe their involvement is beneficial to their affiliations agenda. • Policies and regulations created seem beneficial and appropriate to implementing bodies. • Belief by stakeholders that the planning process and implementation has been efficient and effective.
Evaluation, adaptability, and flexibility	• Institutions and practices have administrative flexibility for place specific conditions. • Long term goals have been set regarding the health of the watershed. These goals are regularly monitored and re-evaluated. • Mechanisms are in place to consistently monitor change. New information and knowledge is used to improve plans and decisions. • Clear stipulations in the watershed plans of responsibilities for who should be conducting monitoring, evaluation (and which outputs and outcomes should be evaluated), and how data

	should be stored, communicated, and accessed. • Flexibility for implementation depending on place specific needs.

*Elements and indicators based on: (Ananda & Proctor, 2013; Ansell & Gash, 2008; Cave, Plummer, & de Loë, 2013; Connick & Innes, 2001; Emerson, Nabatchi, & Balogh, 2012; Himmelman, 2002; Huck, 2012; Minnes, 2012, 2015; Noble & Basnet, 2015; Rogers & Weber, 2010; Simms & de Loë, 2010; Simms, Lightman, & de Loë, 2010; St-Jacques, 2001; Vodden, 2015; Water Policy and Governance Group, 2011; Weber, 2012)

2.6. Conclusion

This chapter provided definitions and indicators on the main topics, concepts, and conceptual frameworks used in this research. The capacity and collaborative watershed governance frameworks that have been used in this research provide a structure to further understand how SWP can be enhanced in rural regions. The utilization of both frameworks in data collection and analysis helped to answer the research questions (See Section 1.2) associated with this research (see Sections 3.2, 4.2, 5.2 below for more detail regarding research methods). For example, both the capacity and collaborative watershed governance frameworks provided indicators to answer the research question 1: what have been the successes and challenges with SWP planning and implementation in Ontario? This question is an overarching question answered in Chapters 3-5.

As this research explored the efficacy of SWP from a largely policy and practice perspective, assessing the presence and absence of SWP capacity is important. The element and indicators outlined in Table 2.1 provide an important foundation to how SWP capacity was assessed for both municipally and privately-serviced water systems in the case study areas. The capacity framework used in this research aided in answering the

research question (question 1): did the SWP planning process under Ontario's CWA build capacity for SWP in municipally serviced rural municipalities? The SWP capacity framework also helped to answer the research question (question 3): do privately-serviced rural municipalities in Ontario have the capacity for SWP? These questions are answered in Chapters 3 and 4 respectively. Furthermore, it is important when examining SWP to also reflect on the overall governance of the entire watershed that the source water supplies are a within, and how these governance structures may impact SWP for both serviced and privately-serviced areas. The elements and indicators provided in Table 2.4 outline how watershed governance is evaluated for the purposes of this research. This framework helps to answer the research question (question 4): to what extent has the CWA been an example of collaborative watershed governance? Findings from this evaluation are provided in Chapter 5. All findings as well as final conclusions and implications of the research are summarized in Chapter 6.

3. Ontario's *Clean Water Act* and Capacity Building: Implications for Serviced Rural Municipalities

By: Sarah Minnes

This article was published 18 July 2017 in Water (Switzerland), *9*(7).

http://doi.org/10.3390/w9070538 [4]

Abstract: This research explores Ontario's *Clean Water Act (S.O. 2006, c. 22)* and its contribution to capacity building for rural municipalities impacted by source protection plans created under the *Act*. SWP (SWP) under the *Clean Water Act (S.O. 2006, c. 22)* is explored drawing from a capacity framework. A case study approach has been employed to allow for in depth exploration of the experience within the Cataraqui Source Protection Area and the North Bay-Mattawa Source Protection Area, where key informant interviews were conducted. Findings are outlined looking at four elements of capacity for SWP: institutional, financial, social, and technical/human. It was found that the process was successful for building capacity in the serviced rural municipalities involved but did not provide any meaningful protection for areas reliant on private drinking water systems such as wells. Several improvements to the legislated process were suggested including greater flexibility for local circumstance and better methods for engagement of First Nations and the general public. It is unknown if this capacity will be sustained as the program continues and provincial funding is reduced. Reduced funding will particularly

[4] Small editorial changes were made to this article for consistency and formatting purposes.

impact rural communities that lack the internal human and financial capacity to implement SWP policies without the assistance of provincial funding and conservation authority staff (who also rely on provincial/municipal funding sources). Ultimately, it was found that SWP in rural areas requires enforceable mandatory legislation; sustainable provincial funding and municipal fiscal frameworks to support ongoing SWP planning and implementation; technical aid at the regional level; and support and commitment to SWP at the local level (e.g., municipalities, local health units, landowners, residents and watershed users).

Keywords: source water protection; rural; capacity; rural drinking water

3.1.Introduction

The safety of our drinking water can be taken for granted until tragedy shakes that trust. In 2000, the contamination of Walkerton, Ontario's water supply by *Escherichia coli* O157:H7 and *Campylobacter jejuni* killed seven people and resulted in 2300 cases of serious illness (de Loë, Murray, Michaels, & Plummer, 2016; Livernois, 2002). The primary source of the contamination was manure from a nearby farm entering the municipal well (O'Connor, 2002a). One way to prevent such a contamination is keeping contaminants out of drinking water sources through SWP (SWP) (O'Connor, 2002b). SWP is, "the development and implementation of policies, plans and activities to prevent or minimize direct or indirect release of pollutants into surface or groundwater resources currently used or intended to be used in the future as sources of drinking water" (Ivey, de Loë, Kreutzwiser, & Ferreyra, 2006a, p. 944). SWP can be an important first line of

defense in ensuring drinking water safety, and is an essential component in a multi-barrier approach to drinking water management (de Loë et al., 2016; Hrudey, Payment, Huck, Gillham, & Hrudey, 2003). SWP reduces costs of treatment and enhances drinking water safety (Baird, Plummer, Morris, Mitchell, & Rathwell, 2014; de Loë & Kreutzwiser, 2005; Patrick, 2011). Through SWP, "drinking water safety will be enhanced because treatment systems (especially in smaller communities) may not be able to eliminate all potential chemical, biological and radiological contaminants" (de Loë & Kreutzwiser, 2005, p. 243). Being precautionary rather than reactive in managing drinking water contaminants can also lead to significant monetary savings. For example, the financial cost of Walkerton's contamination was over $64.5 million (Livernois, 2002; O'Connor, 2002b). The United States Environmental Protection Agency found that remediation of groundwater supplies after a contamination has already taken place can be 30–40 times more costly than preventative SWP measures, and the cost can be up to 700 times greater in rural areas (Simpson & de Loë, 2014). However, SWP requires a certain amount of capacity that is often limited in rural communities with small populations, limited tax bases, and few (if any) technical staff (Minnes & Vodden, 2017; Rawlyk & Patrick, 2013).

This paper outlines findings from research exploring the implications for rural municipalities of Ontario's SWP legislation, policies and programs. This paper focuses on the findings pertaining to the municipalities with public drinking water systems that are included in the Cataraqui Source Protection Area (CSPA) and the North-Bay Mattawa

Source Protection Area (NBMSPA)—two source protection areas under the *Clean Water Act (S.O. 2006, c. 22)* (CWA). The research questions addressed in this paper are:

i. What have been the successes and challenges with SWP planning and implementation of source protection plans in Ontario?
ii. Did the SWP planning process in Ontario, under the CWA, build capacity for SWP in municipally serviced rural municipalities?

This paper outlines through a capacity framework, ways in which the CWA has improved the capacity for SWP for those rural municipalities with municipally operated drinking water systems in the case study regions. It is recognized that there are additional rural communities in these case study areas that either rely on private drinking water supplies or are First Nation communities. Meaningful discussion on rural communities' capacity for SWP for these types of other systems will be limited to further papers (see Chapter 4).

3.1.1. Source Water Protection Under Ontario's Clean Water Act (S.O. 2006, c. 22)

Following the tragedy in Walkerton, Ontario, a public inquiry was conducted under the direction of Justice Dennis R. O'Connor. *The Walkerton Inquiry* produced two reports, Part 1 outlining the causes for the contamination and Part 2 providing strategies to avoid such a disaster in the future (Hrudey, 2011). One of the key recommendations in Part 2 was the creation of watershed based source protection plans (O'Connor, 2002b). Though there were policy tools for municipalities in regard to SWP previous to the Walkerton

tragedy, these were implemented in an ad hoc manner (de Loë, Kreutzwiser, & Neufeld, 2005; Plummer, Velaniskis, de Grosbois, & Kreutzwiser, 2010). The CWA and its regulations were created in response to Justice O'Connor's recommendations (Baird et al., 2014; de Loë et al., 2016; Plummer et al., 2010) and resulted in Ontario "making more comprehensive efforts to focus on SWP than in other Canadian jurisdictions" (Hrudey, 2011, p. 9). Ontario's *Act* was designed to be an integrated, science-based approach, using a governance structure that engaged multiple stakeholders. There are nineteen regional level source protection areas and regions that were created across the province, predominantly in densely populated Southern Ontario. There are sixteen source protection regions representing groupings of two or more conservation authority boundaries, and three source protection areas that were created using the boundary of one single conservation authority. Conservation authorities are local water management organizations, some existing since 1946, under the *Conservation Authorities Act* (de Loë et al, 2016; Plummer et al., 2010). Conservation authorities (a lead conservation authority in the case of the source protection regions) have acted as the source protection authority, providing technical and administrative support to the source protection committee. Source protection authorities have coordinated the process under the CWA and were tasked with overseeing the assessment reports, the planning process, and ongoing implementation, monitoring, reporting and updating (Mitchell, Priddle, Shrubsole, Veale, & Walters, 2014).

Each source protection area/region engaged multi-stakeholder source protection committees in order to assess threats and develop regional source protection plans (Baird

et al., 2014; Plummer et al., 2010). The source protection authority appointed source protection committee members, with the exception of the chair who was appointed by the Minister of Environment and Climate Change. The source protection committees were composed of 10–22 members. The committees consisted of 1/3 municipal sector; 1/3 commercial, agriculture or industry; and 1/3 from the academic, professional, non-government organization sectors or the general public. If there were one or more First Nation communities in the source protection area/region, committees of 10, 16 or 22 members had to include 1, 2 or 3 First Nation representatives, respectively. Liaisons such as public health representatives and Ministry of the Environment and Climate Change representatives were also invited to committee meetings (Ontario Ministry of Environment, 2006a).

Municipalities ensure mandatory policies under the source protection plans (i.e., those addressing significant threats) are implemented using planning tools such as by-laws and Official Plan policies (Plummer et al., 2010) as well as through appointing a risk management official (Ontario Ministry of the Environment and Climate Change, 2006). The implementation of the 22 source protection plans created is currently underway (Ontario Ministry of the Environment and Climate Change, 2017). The Ontario CWA was specifically created to better protect drinking water supplies by building capacity in local areas, using multi-level governance structures to create source protection plans on a watershed basis (Ontario Ministry of the Environment and Climate Change, 2006). To what extent the CWA has built capacity for SWP, particularly in the rural municipalities involved, will be explored in this paper.

3.1.2. Source Water Protection and Capacity

Best practices for SWP cannot be achieved without adequate capacity, particularly at the local level (de Loë & Kreutzwiser, 2005). Generally, capacity for SWP is described as "the ability, or capability, of a local community to meet regulations, policies or standards that have been established" (Rawlyk & Patrick, 2013, p. 22). Capacity for SWP is a multi-faceted notion that has been conceptualized as having four main elements: institutional, financial, social, technical/human (Rawlyk & Patrick, 2013; Robins, 2007; 2008) (Table A3.1). Capacity is needed at multiple levels to successfully undertake SWP. Provincial and federal capacity can limit SWP efforts. It was argued that capacity in Canada for water management, as well as learning and sharing amongst jurisdictions, is deficient due to the federal government's failure of investment and leadership in national water management activities (Robins, 2007). SWP also strains local technical skills and basic resources. Devolution of responsibilities to the local level must be matched with the proper power and resources to enact new responsibilities (Norman & Bakker, 2009). Best practices in SWP stress the need to develop capacity at the local level. Furthermore, support for SWP efforts at the local level need to be complemented with legalized institutional arrangements, financial support, technical support and data, as well as social capacity building (e.g., awareness building campaigns and opportunities for public engagement) (de Loë & Kreutzwiser, 2005). Capacity building in water management and planning at the local community level can provide opportunities for future collaboration, better integration of water plans and the creation of networks that further understandings of catchment issues (Ananda & Proctor, 2013; Emerson, Nabatchi, & Balogh, 2012).

Moreover, there must be acceptance of source protection plans at the local level if local actors are also expected to enforce these plans (Ivey, de Loë, & Kreutzwiser, 2006b). Capacity building at the local level aids in developing this acceptance.

Overall, it is clear that enhancing local capacity for SWP is critical (Ivey et al., 200a). Municipalities are the frontline actors for drinking water management, with responsibilities for land use planning, water supply distribution, wastewater treatment, and SWP (Ivey et al., 2006b). Unfortunately, capacity at the local level is particularly limited in rural communities, making places like Walkerton, Ontario (with a population of 4800 people at the time of the outbreak in 2000) (de Loë et al., 2016) prime places for drinking water safety vulnerabilities. SWP capacity related limitations in rural areas include (but are not limited to): lack of technical expertise and staff; small revenue bases; accessibility difficulties; and large geographies (Ivey et al., 2006a; Minnes & Vodden, 2017; Robins, 2007; Kot, Castleden, & Gagnon, 2011). For example, Canada-wide studies suggest that insufficient financial capacity to hire expert consultants, technical expertise and other human capital, can be a barrier to SWP in small to medium water system operations (Patrick, 2011, p. 388). This paper will evaluate through a capacity framework (Table A3.1) if and how the process under the CWA has built capacity for SWP in rural municipalities impacted by the plan.

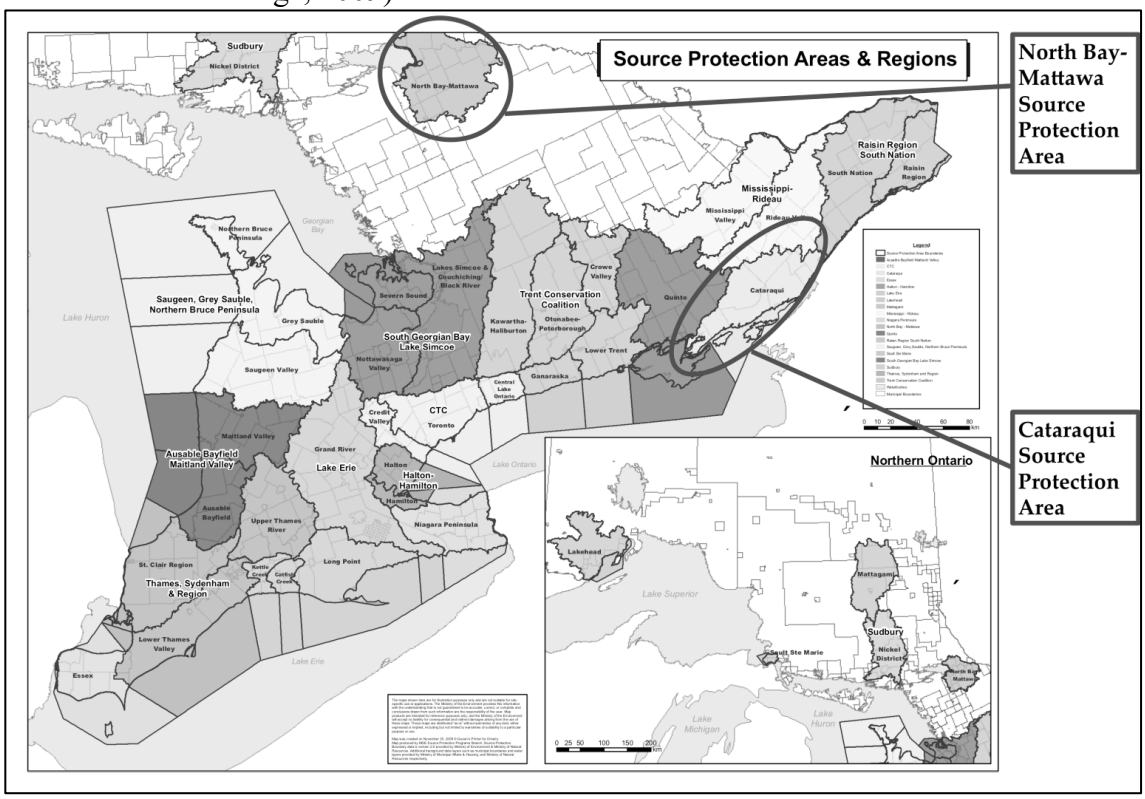
3.2. Materials and Methods

A case study approach was employed in this research (Yin, 2011) to allow for in depth exploration of the experience within two rural regions. The two SWP regions (displayed

in Figure 3.1) chosen were the CSPA in eastern Ontario and the NBMSPA in "near north" Ontario. These case study regions were ideal because of their largely rural composition. For this research, the very inclusive definition of rural from the Ontario Ministry of Agriculture, Food and Rural Affairs was used. This definition outlines rural as: "all Statistics Canada's census subdivisions (including lower-tier and single-tier municipalities) that meet at least one of the following criteria, have a population of less than 100,000 people; and/or have a population density of 100 people/km^2 or less" (Ontario Ministry of Agriculture, Food and Rural Affairs, 2017, para. 8). Under this definition every municipality in the case study regions, with the exception of Kingston, Ontario in the CSPA, is considered rural (Cataraqui Source Protection Committee, 2014; North Bay-Mattawa Source Protection Committee, 2015; Statistics Canada, 2011).

The research began with an extensive literature review and document analysis, which included academic literature and policy/document analysis of Ontario's drinking water legislation, regulations, policies and programs and other related documents such as websites and source protection committee meeting minutes. Further work was also done on refining definitions and indicators of capacity for SWP (Table A3.1). Once definitions and indicators were refined, interview guides were created and semi-structured key-informant interviews were conducted. More information on the interviews conducted and analysis is explained below.

Figure 3.1. Case Study Locations (Ontario Ministry of the Environment and Climate Change, 2009)



3.2.1. Semi-Structured Key-Informant Interviews

To answer the above research questions 31 key informant interviews were conducted with various stakeholders in both case study regions (12 participants in NBMSPA; and 14 participants in CSPA), as well as experts with a provincial perspective (five in total). One key informant decided to withdraw their information from the study, resulting in 30 interviews being used in analysis. All key informant interviews were conducted in confidence as per the informed consent process. The Grenfell Campus Research Ethics Board granted ethical clearance to this research and found the research to be in ethical compliance with the Tri-Council Guidelines (reference number 20161916). Key

informants were targeted based on their familiarity with the rural context as well as their role within the source protection planning and implementation process. Semi-structured interviews (a form of qualitative interviewing) were conducted with key informants, using two interview guides. One guide was created for provincial government/provincial wide informants, and one guide was created for regional informants that contained more specific questions about the planning and governance process. The interview guides contained questions related to various topics, including questions assessing elements for capacity for SWP (Table A3.1). Other factors related to SWP topics were also explored including questions relating more specifically to watershed governance. Findings directly related to watershed governance were limited to further papers (see Chapter 5).

A semi-structured interview method was chosen, as opposed to a structured interview design, to allow for robust and meaningful discussion with key informants. This qualitative, more conversational interview approach facilitates two-way interactions, delving into specific contextual conditions of interviewees (Yin, 2011). Yin (2011) explains about this approach, “this aim suits one of the fundamental objectives of qualitative research, which is to depict a complex social world from a participant’s perspective (Yin, 2011, p. 135). Given the complexity of the subject matter being discussed, this approach was deemed the most appropriate. In total, diverse perspectives on the topic were provided from nine source protection committee members (source protection committee members interviewed represented a range of affiliations including actors from agriculture, business, municipal, academic, and public health sectors), four provincial staff, eight upper and lower tiered municipal staff and elected officials, five

conservation authority/Conservation Ontario staff, and four non-governmental or consultants with expertise in rural SWP. A further breakdown of the key informants in each case study region is displayed in Table 3.1. General identifiers have been used in this article to protect the confidentiality of the participants.

Table 3.1. Key Informant Interviews Analyzed (n = 30)

Sector	**Identifier in Article**	**Total**	**CSPA**	**NBMSPA**	**Ontario Wide**
Source protection committee member	SPC Participant	9	4	5	0
Provincial staff	Provincial Participant	4	3	1	0
Upper/lower tiered municipal staff and elected officials	Municipal Participant	8	4	4	0
Conservation authority/Conservation Ontario staff	CA Participant	5	2	1	2
Non-governmental expert or consultant	Other Participant	4	0	1	3
Total		30	13	12	5

3.2.2. Analysis

Analysis was conducted using predetermined indicators, coding interview transcripts (or in one case interview notes). Indicators facilitating capacity for SWP can be found in Table A3.1. Coding was conducted using NVivo qualitative research software, classifying key informant responses according to each element identified in Table A3.1. After general coding was conducted, the researcher went back to each code and coded it for displaying either the presence or absence of the element (using the indicators for each element). After the second round of coding, a chart was made of the percentage of interviews in each case study region and from Ontario wide interviews that discussed the

element and the author confirmed through their answers the presence or absence of the element. Further analysis was done from these codes, delving into the evidence and deriving conclusions from both the percentages and the raw qualitative data. The last step of analysis involved identifying the key findings (determined based on findings confirmed by the greatest number of key informants) and creating charts of the number of key informants who supported each key finding.

3.3.Results

This section outlines the findings from the key informant interviews conducted regarding the successes and challenges of the CWA and implications of the *Act* on the capacity for SWP in particularly rural areas. For the purposes of this paper, findings have been derived for municipalities with public drinking water systems that were included in the source protection plans for the CSPA and the NBMSPA. Therefore, the findings exclusively apply to serviced municipalities (i.e., municipalities with drinking water systems owned by the municipality). Table 3.2 provides a summary for the presence of or absence of all elements of capacity according to region. Further explanations of these findings are described in subsequent sections. Table 3.2 outlines the percentage of interviews that discussed either the presence or absence of the element of capacity. Many informants confirmed both the presence and absence of an element. Below in Table 3.2, *n* represents the number of interviews which discussed the element (not all interviewees discussed each element as they did not have expertise or experience in that area and could not therefore answer the interview questions relating to the element). Indicators used to assess presence or absence of an element can be found in Table A3.1 (an appendix to this

chapter). To further support overall findings, tables have been provided in Sections 3.3.1–3.3.4 denoting how many participants supported each major finding related to each element of SWP capacity.

Table 3.2. Interviews Indicating a Presence and/or Absence of Elements of Capacity

Institutional			**Financial**			**Social**			**Technical/Human**		
	+	−		+	−		+	−		+	−
C (n = 12)	100 %	83 %	**C** (n = 11)	100 %	64 %	**C** (n = 9)	100 %	78 %	**C** (n = 11)	100 %	45 %
NB (n = 12)	100 %	83 %	**NB** (n = 11)	100 %	55 %	**NB** (n = 12)	92 %	75 %	**NB** (n = 12)	100 %	67 %
O (n = 5)	100 %	100 %	**O** (n = 5)	100 %	60 %	**O** (n = 1)	100 %	0 %	**O** (n = 4)	100 %	100 %

Notes: + = Presence; − = Absence; C = CSPA; NB = NBMSPA; O = Ontario Wide; *n* = The number of interviews that discussed the element.

3.3.1. Institutional

Institutional capacity for SWP refers to the legislation, regulations, policies, protocols, governance arrangements and delegation of responsibility to plan and enact SWP (Rawlyk & Patrick, 2013; Robins, 2008). In total, 29/30 interviews conducted discussed institutional capacity for SWP under the CWA. All of these participants noted the process under the CWA as successful in raising institutional capacity for the municipalities included in the source protection plans (Table 3.2). Firstly, 24 participants noted the enforceable and mandatory nature of the CWA legislation itself as integral to raising the institutional capacity for SWP (Table 3.3). The Walkerton tragedy, and the subsequent *Walkerton Inquiry* (O'Connor, 2002a; 2002b) was noted by 20 participants as the driving force for stricter legislation for safe and clean drinking water in Ontario. Twenty informants explained that the CWA legislation and associated regulations delineated

governance processes and protocols for how to create source protection plans and roles within implementation (Table 3.3). For example, the source protection committees were regulated through Ontario regulation 288/07 of the CWA. The governance choice to have the conservation authorities as the source protection authority was a natural fit, as conservation authorities already had experience working with municipalities at a watershed level. Source protection committee members had to go through an interview process, and conservation authorities appointed committee members. Agricultural representatives appointed by the conservation authorities were elected in local elections facilitated by the Ontario Farm Environmental Coalition and the County Federations of Agriculture. Chairs were appointed by the Ministry of the Environment and Climate Change. The source protection committee had a good mix of actors, representing a diverse range of views (social, economic and environmental). One SPC Participant explained that the committee, "*...was a good opportunity to network and exchange ideas and you know ... put me in touch with some of the folks that I wouldn't normally be in touch with*" (SPC Participant). The process allowed for ample discussion and debate, with topics of concern spanning meetings, and often requiring additional research by the source protection authorities and provincial liaisons. All decisions were based on consensus.

Table 3.3. Key Findings for Institutional Capacity

Indicators of Presence	**No. of Interviews Confirming Indicator**
Creation of mandatory and enforceable legislation.	24
Creation of a clear governance structure and delineation of implementation responsibilities.	20

Indicators of Absence	No. of Interviews Confirming Indicator
The exclusion of certain communities from the mandatory protection of the CWA (e.g., First Nation communities, private drinking water systems).	25
Not enough flexibility for locally relevant concerns (e.g., Great Lakes, private well clusters, pipelines).	22
Lack of involvement of First Nation communities' in source protection committees and plans (there was indication by key informants this is being looked into).	10
Program and technical guidelines were not fully scoped resulting in inefficiencies, frustrations, and an overall very lengthy process.	9

As discussed above, the CWA was noted by 24 participants as particularly effective in giving the created source protection plans the needed legislative power to be enforced through clear implementation responsibilities and consequences, such as Official Plan and by-law conformity (Ontario Ministry of Environment, 2006) (Table 3.3). In the creation of the source protection plans, the source protection committees strategically evaluated where gaps in current legislation existed. The policies under the plan aimed to fill these gaps. In addition to the CWA, other complementing legislation ensures implementation of SWP policies. These other prescribed instruments issued by the provincial government that contain provisions that can be used in SWP include the: *Environmental Protect Act (1990)*; *Ontario Water Resources Act (1990)*; *Pesticides Act (1990); Safe Drinking Water Act (2002); Aggregate Resources Act (1990); Nutrient Management Act (2002)* (North Bay-Mattawa Source Protection Committee, 2015). Instruments that are enabled under Ontario legislation that are relevant to source protection planning are listed in Table 3.4. For example, Section 19 of the *Safe Drinking Water Act (2002)* outlines a statutory

standard of care that requires those persons that have decision-making authority over municipal drinking water systems to act honestly, competently and with integrity when making decisions regarding municipal drinking water systems. Responsible parties (including municipal councillors) can be prosecuted and convicted under this section (Ontario Government, 2002).

Table 3.4. Ontario Legislation Relevant to Source Protection Planning (North Bay-Mattawa Source Protection Committee, 2015, pp. 28-29)

Act	**Relation to Source Protection Planning**
Environmental Protect Act (1990)	Approvals for the use, operation, establishment, alteration, enlargement or extension of waste disposal sites or waste management systems
	Approvals issued for the use, operation, establishment, alteration, enlargement or extension of waste disposal sites or waste management systems, or the establishment, alteration, extension or replacement of new or existing sewage works
	Renewable energy approvals
Ontario Water Resources Act (1990)	Permits to take water
	Approvals to establish, alter, extend or replace new or existing sewage works
Pesticides Act (1990)	Pesticide permits for land exterminations, structural exterminations and water exterminations
Safe Drinking Water Act (2002)	Drinking water works permits
	Municipal drinking water licences
Aggregate Resources Act (1990)	Site plans included in applications for licenses
	Licenses to remove aggregate from pits or quarries
	Site plans accompanying applications for wayside permits
	Wayside permits to operate pits or quarries
	Site plans included in applications for aggregate permits
	Aggregate permits to excavate aggregate or topsoil
Nutrient Management Act (2002)	Nutrient Management Strategies and Plans
	Non-Agricultural Source Material Plans

Binding policies were created in the source protection plans for each region including efforts such as outreach and education, raw quality samplings, and emergency and spill response plans (Cataraqui Source Protection Committee, 2014; North Bay-Mattawa Source Protection Committee, 2015). The types of policies were outlined in the plans along with rationales, prescribed legal effects by tools, and prescribed instrument decisions that must conform to a policy (e.g., Official Plans). It should be noted not all policies created in the source protection plans were mandatory. The types of policies range from: must conform/comply with policies; have regard to policies; and non-legally binding policies. In short, a must conform/comply policy is instituted to address a significant drinking water threat/condition, as outlined in the plan (Cataraqui Source Protection Committee, 2014; North Bay-Mattawa Source Protection Committee, 2015). Though the non-legally binding policies have no legal impact, there was indication from a provincial government staff member that the Minister of Environment and Climate Change read and is considering all non-binding policies. One provincial government staff member explained in regard to the non-binding policies included in the plans,

> *Their needs to be a rationale for why we are not implementing that. So kudos to the people that really did push the boundaries for us because it really does highlight for us that we could be doing a better job in certain areas* (Provincial Participant).

This indicates the inclusion of the non-binding policies were not done in vain by the source protection committees, and could lead to regulatory reform in the future.

Part IV of the CWA lays out the regulation of drinking water threats identified in the source protection plans and the various roles in enforcement shared between municipalities, boards of health, planning boards, source protection authorities, and provincial actors. Mechanisms for implementation are also included in the CWA legislation regarding monitoring programs and annual progress reports. Twenty key informants noted that even though they may not agree with decisions made in source protection plans, all implementers of the plans have clear responsibilities, and know their obligations in implementation (Table 3.3). The source protection authorities (i.e., the conservation authorities) as well as the risk management officials play an important role in monitoring and enforcement efforts. The risk management official and inspector help address legally binding policies under the source protection plan, and work with implementers (e.g., municipalities, businesses, landowners) to ensure policies are being followed. It was explained by a rural municipal Risk Management Official on the role,

> *Basically, I'll ask you really nicely to do it. Then I'll tell you to do it, then I will order you to do it. And if you don't do it on our order I will do it and put it on your tax bill* (Municipal Participant).

Evidently, there are clear steps to ensure the "must conform" policies under the source protection plans are abided by. However, as will be discussed in subsequent sections, there was some concern expressed by key informants regarding funding for further iterations of the plan and the same level of continued support for implementation measures.

Annual progress reports are collected by conservation authorities and submitted to the Ministry of the Environment and Climate Change. Conservation authorities are also able to submit letters to the Ministry of the Environment and Climate Change on items to consider in future plan reviews and iterations. Nine participants noted this first round of planning was rolled out in stages, causing source protection committees and authorities to go back and re-evaluate decisions or re-do certain activities related to the assessment report to address refinements to the Tables of Drinking Water Threats. The Tables of Drinking Water Threats is a document issued by the Ministry of the Environment and Climate Change and contains a series of tables of potential drinking water threats. The document identifies under which circumstance the listed drinking water threats can be categorized in the source protection plans as a significant, moderate or low drinking water threat (Cataraqui Source Protection Committee, 2014). The narrowing scope of the work as the program rolled out was often a source of frustration for source protection committee members (Table 5.3). This resulted in much inefficiency in the planning process. One municipal staff member said, "*...it was a little bit like two steps forward, three steps back*" (Municipal Participant). Another Conservation authority staff member said,

> *We weren't always 100% sure about some of the technical rules for the assessment work, and those are actually being reviewed right now by the province, which is good. In any kind of process the first phase, the first step is your base model and then you make iterative improvements and we are pleased to see that the province is going to make improvements for the second round. Things are going to be better and better* (CA Participant).

There is positivity regarding the next round of planning, and hopes that it will be more clearly scoped as the program matures.

As mentioned, the majority of participants (24) noted having SWP legislated under the CWA was beneficial in raising institutional capacity (Table 5.3). However, there were also concerns regarding the prescriptive nature of the CWA and ways in which the CWA restricted the planning process and local autonomy in deciding what could be included in the source protection plans. For example, the Tables of Drinking Water Threats were important in making decisions technically defensible. However, 22 participants noted the process being overly rigid and sometimes insensitive to specific local issues and circumstances (Table 3.3). One such example is the ability to address issues with Great Lakes intakes in the CSPA. Another example includes allowing the Energy East pipeline to be considered a threat in the NBMSPA. Though there was some flexibility for local circumstance and to add local threats to the list of prescribed activities needing to be addressed, it did not always cover every circumstance. On the other hand, the plans had to include legally binding policies for municipalities for threats that would never be able to occur in the areas designated or would require policies that were redundant. For example, a municipal staff member explained,

> *... airplane de-icing, salt and storage, winter snow storage that were identified as threats and that we zoned for. None of those activities would even be able to occur in the IPZ-1 or 2 areas. Because it is basically just a shoreline in the urban area so you get into the threats for the issue contributing area a little bit more possibly there. So, the ones in town, I mean that area is already developed and not getting any kind of airport anytime* (Municipal Participant).

The exclusion of certain communities from the mandatory protection of the CWA was noted by 25 key informants as a shortcoming of the legislation (Table 3.3). As of now First Nation communities, municipally serviced systems outside of current source protection areas/regions, and those drinking water systems not part of municipally owned drinking water systems (e.g., private wells, private surface water systems) were excluded from requiring mandatory source protection under the CWA. There were no First Nation communities located in the CSPA. In the NBMSPA the Nipissing First Nation decided not to be part of the process. One provincial government participant explained there is currently a mandate at the provincial level for better inclusion of First Nations in the process. There is the ability to elevate either a First Nation community or a clustering of wells into source protection plans under the CWA (Ontario Ministry of Environment, 2006). In the NBMSPA, they did choose to elevate a private well clustering in the community of Trout Creek (which has now been amalgamated into the Municipality of Powassan) into their plan. However, the town fought to opt-out of the process in the end. This was due to a variety of reasons, mainly concerns of house resale values if their well to septic bed distance was labeled as a significant drinking water threat. Though the plans did not intentionally mandate protection for private drinking water sources, some of these sources were protected due to their location within a municipal vulnerable area. For example, if a private well fell within a vulnerable area of a municipal drinking water intake, there were legally enforceable measures under the source protection plans and other legislation protecting this source. For example, the *Building Code Act, 1992* and the Building Code require mandatory maintenance inspections of every on-site sewage system (e.g., septic system) in vulnerable areas where these systems are identified as

significant threats to a source of drinking water (e.g., wellhead protection areas A and B) (Cataraqui Source Protection Committee, 2014). The legislation does allow for planned municipal water systems to be elevated into the plan.

The process under the CWA did raise the institutional capacity for SWP in rural communities in the source protection areas, most notably for creating plans that had policies that must be implemented. It was mentioned by 11 participants, especially for small rural communities with limited financial capacity and staff, that voluntary actions are often not implemented. Ultimately, institutional measures such as enforceable legislation and guiding governance structures are needed in SWP and were strongly displayed in the process under the CWA.

3.3.2. Financial

Financial capacity for SWP refers to the ability to acquire adequate funds to pay for SWP efforts as well as for ongoing planning, governance and management efforts (Rawlyk & Patrick, 2013; Robins, 2008). In total, 27/30 interviews conducted discussed financial capacity for SWP under the CWA. As highlighted in Table 3.2, evidence of the presence of financial capacity was strong in each case study region, and indicated as present from the Ontario wide informants. The majority of comments indicating a presence of financial capacity referred to the funding available during the planning process and in the creation of the terms of reference, the assessment report, and the source protection plans themselves (Table 5). Provincially, the Ministry of the Environment and Climate Change has invested over $250 million in the program thus far (Ontario Ministry of the

Environment and Climate Change, 2017). It was explained by a municipal staff member, "*the province paid for everything. So, they paid through the conservation authorities, the conservation authorities hired the consultants. The township didn't have to pay anything beyond the staff time to review and implement"* (Municipal Participant).

Provincial funding programs such as the Source Protection Municipal Implementation Fund was imperative in funding both voluntary and mandatory implementation efforts (including staffing costs). This funding was noted by six participants as being especially important for rural municipalities that would not have been able to achieve delegated duties without additional resources. Municipal key informants noted that, thus far in these early stages of implementation, SWP under the CWA has not been a financial burden on them as there has been sufficient provincial funding. Landowners who implement plan policies have also been provided with funding through the Ontario Drinking Water Stewardship fund that helped with efforts such as septic system replacements and the general outreach and education of people that were going to be impacted by the source protection plans. There have also been specific funding programs for farmers and support from the Ministry of Agriculture, Food and Rural Affairs through their nutrient management legislation and plans. However, one participant expressed some concerns about this funding being very competitive and requiring a farm plan, resulting in individuals having to apply a couple times before funding was granted.

Table 3.5. Key Findings for Financial Capacity

Indicators of Presence	**No. of Interviews Confirming Indicator**

Over $250 million of provincial funding provided to the program and related activities	27
Indicators of Absence	**No. of Interviews Confirming Indicator**
Ongoing implementation, monitoring and evaluation funding from the provincial government is unknown. This impacted some decisions made in source protection plans (i.e., inclusion of private well clusters, policies requiring risk management officials).	16
Financial ownership of the program is lacking at the municipal level, especially in rural municipalities.	6
Diminishing provincial funding has resulted in a loss of human capacity at the conservation authorities.	6

Despite strong consensus regarding the presence of financial capacity for the process under the CWA, there were also less frequent comments regarding the absence of financial capacity. For example, 16 participants expressed concern about the impacts of unknown future funding from the provincial government for implementation, monitoring and evaluation of source protection plans (Table 3.5). It was explained in the Cataraqui Source Protection Plan,

> …most municipalities stressed their unwillingness to implement policies, especially non-legally binding policies, unless there is provincial funding and other resources made available to do so. Concerns were also raised by local residents that could be impacted by the Plan (Cataraqui Source Protection Committee, 2014, p. 7)

In the village of Mallorytown in the CSPA, there was significant push back from residents and municipal officials on implementing SWP policies for a 17-unit apartment building obtaining water from a well. The building and the well are both owned by the United Counties of Leeds and Grenville, therefore triggering the CWA legislation, as a public water system (Cataraqui Source Protection Committee, 2014). One source

protection committee member explained that the concerns were mainly due to financial implications of implementation such as changes to septic fields, upgrades to oil tanks, and impacts on future development. With ongoing implementation funding unknown, this impacted some of the decisions that the source protection committees made. For example, one source protection committee member explained, "*We specifically did not go down the path of having a risk management officer. You know because had that happened then that would have been costs to all of the municipalities, that there was no funding for*" (SPC Participant). As noted in the previous section, the community containing the cluster of private wells that were elevated into the source protection plan in the NBMSPA was also concerned about implementation costs and implications on housing prices. Under the CWA, municipalities are responsible for implementing policies and funding risk management officials. This research shows that financial ownership by municipalities may be lacking, especially for those rural municipalities in the case study regions.

It was clear that municipalities with supportive councils that prioritized water were more optimistic about implementation. One consultant stated, "*…if you want to have a safe water supply you have to be prepared to pay for it*" (Other Participant). However, municipal ownership of the full fiscal responsibilities of SWP was not always the case. Six participants indicated financial ownership of the program is lacking at the municipal level, especially in rural municipalities (Table 3.5). One conservation authority staff member explained,

They are trying to instill a sense of ownership in the municipalities. It is your drinking water, your people, you help protect it from source to tap. But at least in our area the municipal councils still see it as a shared responsibility with ongoing provincial funding and support (CA Participant).

Clearly, municipalities are still relying on provincial government support for SWP. A concern that will be outlined more in Section 3.3.4 is the impact that diminished funding has had on staff retention at the conservation authorities. Six participants expressed the loss of human capacity at the conservation authorities as a concern resulting from a loss of financial capacity (Table 3.5). These lost conservation authority staff held the institutional knowledge of the SWP planning process and were important actors in aiding municipalities in implementation. One conservation authority staff member mentioned the importance of being creative with funding and staff roles, engaging staff on other mandates so they are not lost. This issue speaks to the larger issue of how reduced financial capacity will impact institutional, technical/human and social capacity for SWP. This reduced capacity due to declining provincial funding is especially concerning for small rural municipalities who lack internal staff for SWP efforts.

Though provincial funding is not guaranteed into the future, a provincial staff representative explained that the CWA and SWP in general is "*embedded in the way we do business*" (Provincial Participant). This does suggest that there will be the availability of some continued funding for municipalities in the future. During the annual reviews conducted by conservation authority staff, future SWP research and activities are prioritized and funding is requested from the provincial government for these activities. This funding is currently on a year-by-year basis. Regarding funding for SWP, one

conservation authority staff member explained, "*Is there enough? There is never enough. And the more you learn the more you find you need to do*" (CA Participant). One conservation authority staff member explained in regard to rural municipalities,

> *Small rural communities often have less capacity and financial resources to assess conditions and threats to their drinking water supplies on an ongoing basis. They generally rely more on the Province to assist in protecting the residents. Some find efficiencies by pooling resources with other nearby communities* (CA Participant).

Into the future, further attention will be needed for sustainable fiscal frameworks for SWP implementation at the municipal level. This will be increasingly difficult for rural municipalities and will require a great deal of prioritization of such efforts, in already limited budgets.

3.3.3. Social

Social capacity for SWP refers to the social factors that influence SWP governance and implementation. This includes social norms (e.g., values, attitudes, behaviours, sense of place, trust, reciprocity, commitment and motivation) that impact public awareness, stakeholder involvement, community support, and public and private partnerships in SWP efforts. This also incorporates structural networks, communications and the relationships between different interest groups and actors (Rawlyk & Patrick, 2013; Robins, 2008). In total, 22/30 interviews conducted discussed social capacity for SWP under the CWA, with most of the interviews displaying high levels of social capacity elements (Table 3.2). When considering factors in social capacity such as leadership at the watershed level, the conservation authorities acting as the source protection authority served a vital function as

the regional experts. The conservation authorities played the role of a facilitator but also often as a negotiator between the provincial and local governments. When conducting the assessment reports and creating the plan there was a great deal of data sharing amongst the source protection authorities, creating structural networks of support. More prominently in the CSPA, as it neighbours other source protection areas, it was noted by a provincial government participant that there was effective coordination and collaboration amongst the five eastern Ontario source protection areas/regions. The provincial government Ministries were also open in sharing data (such as between the Ministry of the Environment and Climate Change and the Ministry of Natural Resources and Forestry). In addition, both case study regions shared SWP related data with local academic institutions and included academic representatives on their source protection committees.

Thirteen participants noted the composition of the source protection committees contributed to increasing social capacity (Table 3.6). Involving a diverse range of stakeholders in the decision-making process created an environment where linkages were either created or strengthened (if existed before the process began) between municipal and provincial agencies, municipalities that shared watershed jurisdictions, community groups and other local experts such as public health liaisons. A source protection committee member explained,

Where an issue crossed over boundaries we had a process, science based, which helped prove the data or findings to everyone, so that people could not get back into their corner

of local autonomy and say well, thanks but we are going to do it this way. We were all in this thing together (SPC Participant).

As represented by this quotation, a critical component of source protection committee participation was the learning and capacity building that occurred with the members around the table. Representatives had a clear idea of why decisions were being made, and would then reach out to the groups they were representing to explain the rationale behind decisions made. A great deal of time and resources were invested in educating source protection committee members (which will be discussed more in Section 3.3.4). Source protection committee members noted a high commitment level to the process, despite long meetings and a great deal of homework. Decisions were based on consensus, often after debating the social, economic and environmental consequences of decisions. Even if it took several meetings to reach an agreement, the process for the active exchange of ideas and viewpoints was entrenched in the CWA and its regulations.

Table 3.6. Key Findings for Social Capacity

Indicators of Presence	**No. of Interviews Confirming Indicator**
Process provided educational opportunities to the public as well as municipal staff and elected officials, increasing awareness about SWP.	16
Process convened a diverse range of stakeholders together on the source protection committee, creating new networks for communication and data sharing.	13
Indicators of Absence	**No. of Interviews Confirming Indicator**
Understanding of the need for SWP and drinking water in general was variable in both regions.	13

Better engagement techniques are required that address barriers to engagement (e.g., long distances to travel to events, lack of an understanding of the technical material, rural residents' aversion to regulation and land use restrictions).	10

Face-to-face interaction with committee members and other stakeholders generated trust in and support for policy decisions. For example, in the NBMSPA the conservation authority worked with local lake associations in a tree giveaway program to reduce erosion and pollution in selected contributing areas. Direct engagement through source protection committee members was noted as especially important for groups such as business owners and the agricultural sector. It was explained the relationship sometimes between the agricultural community and conservation authorities could be strained. It was explained,

> *I made some comments in the review of the conservation authority mandate to that degree. They are not seen as a friendly face in the farm community in most cases. And so they got hurdles to overcome* (SPC Participant).

Traditionally, and especially with SWP matters, the agricultural community has received some blame for contaminating drinking water sources through agricultural practices such as the spreading of fertilizers. For example, in the NBMSPA there was dispute between agricultural groups and environmental non-governmental organizations about the cause of phosphorus loading in one contributing area. One risk management official said, "*you almost have to be a policy expert to be a farmer"* (Municipal Participant). Especially since the Walkerton tragedy, the agricultural community has been highly regulated

through the *Nutrient Management Act*, as well as many SWP policies in the source protection plans relating directly to agricultural practices. The Ontario Federation of Agriculture, the Ontario Farm Environmental Coalition and the Ontario Ministry of Agriculture, Food and Rural Affairs did contribute to building both social capacity and technical capacity in this regard by connecting agricultural representatives across the province during additional training sessions and improving access to technical support on specific issues.

There are no First Nation communities in the CSPA. Nipissing 10 First Nation Reserve (Nipissing First Nation) is located within the NBMSPA (North Bay-Mattawa Source Protection Committee, 2015). Though invited to the committee table, they did not participate. It was suggested by one source protection committee member that this was because the policies under the source protection plan did not impact them, and having to drive to North Bay for meetings every month would be very inconvenient. The same source protection committee member recommended that participation tools should allow for greater flexibility, such as letting participants join through web-conferencing tools.

Sixteen participants said that the CWA embedded public participation and other outreach and education in its planning process (Table 3.6). This included efforts such as public consultation and open house nights, community barbeques, community round table events, shoreline restoration programs, and the use of public service announcements on the television. However, in both regions attempts to engage the public were not always well received. Ten participants indicated that better engagement techniques are required

that address barriers to engagement (Table 6). One source protection committee member explained, "…*the areas where there were no problems, it was like moving mountains to get people to attend*" (SPC Participant). Generally, in the areas where there was a perceived issue with either drinking water or the impacts of the potential policies under the CWA, there were higher participation rates at public events. However, if there were no perceived issues, public engagement was limited. As all SWP efforts require ongoing actions from the public this poses a problem for the present and future implementation of SWP measures. It was mentioned by some informants that the information delivered was very technical and there was confusion around the language used. This lack of understanding made public consultations more about information sharing than meaningful consultation. One Municipal Participant (with expertise in environmental science) explained, "*I read the final report, but I have to go back and look at all the codes because it's like, what the heck, it's in latin*" (Municipal Participant). These technical reports are generally not helpful for the general public. Five participants stressed that the lay summaries provided were very important for ensuring needed behavior changes were being conveyed to the public. One provincial government participant explained further about issues with public engagement,

> *As far as contacting the landowner and helping them understand, their attendance at all our public [events], our open houses and meetings [were] low. Which tends to translate into they don't understand. They were contacted multiple times. Either through stewardship funding available for you know surveys and questionnaires about what we need to know, what activities are happening on your property so that we can have a good conversation with you. All the consultation on the terms of reference, the assessment report, the plan. Here are the policies that apply to you, this is what it is going to mean to you. But again, until someone really shows up on your property and at that point, that's where we as a province said we need to make sure we are supporting that. Because when*

they come to your door and they ask, there needs to be somebody there that can answer. And there also has to be that understanding that there is enforcement behind it should you not comply. So, yeah. We are still working through that piece (Provincial Participant).

Despite repeated attempts to engage the general public during the planning phase it was suggested by one provincial government staff member that engagement may increase during the implementation of the source protection plans as the public realizes how exactly policies will impact them. One source protection committee member suggested in the future that there be more incentives for participation, "…*there would have to be some rewards or motivation to keep people engaged and having them involved in these types of projects*" (SPC Participant). Addressing barriers to engagement also has to incorporate understanding those you are trying to engage. Six participants explained that rural landowners' sensitivity to restrictions on land use might dissuade them from working collaboratively with SWP officials or seeing their role in SWP.

Thirteen participants described people's understandings of drinking water risks as "variable" in their regions (Table 3.6). One participant stated that political will at the municipal level, especially in rural towns, was essential to the council's adopting of non-binding policies outlined in the source protection plans. The tragedy in Walkerton displayed what can happen when those responsible for water systems are negligent, and the fear of repeating this tragedy was a catalyst for stricter source protection by-laws and practices at the municipal level. In addition, as previously outlined, legal ramifications of for decisions concerning drinking water systems have made municipal actors more aware of drinking water issues and cognizant of the impacts of their decisions. There was

evidence in both regions of rural municipalities going beyond the binding policies required in the source protection plans. However, there was still opposition of some policies from rural municipalities in both regions, usually due to fears regarding the financial cost of implementation. Conservation authority staff participants explained that any conflict or opposition of binding policies would be met with further education and outreach. Even though decisions may not have always been well received, there were venues within the process for multiple stakeholders to discuss and debate issues. This process increased communication and linkages between implementing bodies, as well as commitment to policy decisions.

Social norms and valuing of water, as well as the awareness of water issues, have shifted since the Walkerton tragedy. The educational opportunities provided during the process resulted in an increase of local knowledge compared to before the CWA. For example, one conservation authority staff explained, "*It was one of the best things that source protection did was to give people maps that show them where their water comes from*" (CA Participant). However, as there had not been any recent drinking water incidents in either region, it was thought that most people with municipally supplied drinking water take it for granted. As far as the effectiveness of public education and outreach efforts a conservation authority staff member explained, *"...more broadly we didn't do a lot of that necessarily in terms of advancing knowledge on a broader community*" (CA Participant). Evidently, there is still work to be done. Again, as with other capacity building efforts, the plan for the future is unknown, but ongoing outreach and education is being discussed between conservation authorities and municipalities. There is some required outreach and

education on certain items in the source protection plans themselves, which incorporates fact sheets, websites and children's water festivals. However, five participants noted the unknown ongoing provincial funding for SWP implementation could constrain future outreach and education efforts. Two participants indicated that the risk management officials have played an important function in building social capacity, including explaining the reasons for certain policies to those impacted by implementation. These types of methods have increased knowledge at the local level, as well as have contributed to slowly shifting social norms.

3.3.4. Technical/Human

Technical/human capacity refers to the physical and operational ability of an organization to perform SWP management and operations adequately. This incorporates having human resources, with adequate knowledge, skills and experience to properly create source protection plans and implement needed measures (Rawlyk & Patrick, 2013; Robins, 2008). In total, 27/30 informants spoke about technical/human capacity in their interview. Again, similar to the other facets of capacity for SWP the CWA built technical/human capacity in the case study regions (Table 3.2). Seventeen participants noted the development of technical capacity at the municipal level. This increase in technical capacity was attributed to technical aid from the conservation authorities and Ministry of the Environment and Climate Change liaisons (who sat on source protection committees) (Table 3.7). Funding from the Ministry of the Environment and Climate Change raised technical/human capacity at the conservation authority level. The conservation authorities were integral in providing staff with technical expertise that facilitated the process and

who physically wrote the source protection plans. Particularly for rural municipalities, conservation authorities provided much needed support in all facets of the process, including implementation. One municipal staff member explained,

> *The North Bay-Mattawa Conservation Authority kind of spearheaded the whole thing. Basically, I believe we got funding, and then we just basically gave them the funding. And then they hired a consultant to take care of the official plan and zoning bylaw amendments* (Municipal Participant).

A conservation authority staff member explained, "*I think the local decision makers have enough support that even if they don't have a deep understanding themselves they've got the resources at their fingertips and we are always a phone call away too*" (CA Participant). Eighteen participants noted that the process under the CWA has increased human capacity both at the conservation authority level, and in some cases at the municipal level with funding for risk management officials (Table 7). Some smaller municipalities have deferred their risk management responsibilities to the conservation authority. What is of concern is the ongoing support for staff members at the conservation authority. One criticism of the CWA, expressed by one source protection committee member, was that it was legislation to make a product (the source protection plan) and there has not been enough attention to sustaining, particularly, the conservation authorities' role. One source protection committee member explained,

> *Conservation authorities are getting tired. They have no more fiscal and internal capacity to devote to this. They've got to be satisfied that there is a sustainable flow of resources to allow them to continue to do this in a partnership. They can't keep doing this just because it is good for you. Conservation authorities' resources are limited and stretched, and they*

often beg for help from other authorities. And that is why the argument is that senior levels of government have got to get behind this (SPC Participant).

Table 3.7. Key Findings for Technical/Human Capacity

Indicators of Presence	**No. of Interviews Confirming Indicator**
Data created and shared during the creation of the assessment reports increased technical capacity, especially for rural municipalities.	24
Human capacity for SWP efforts increased at the conservation authorities and some municipalities.	18
The provincial government and conservation authorities provided technical support to municipalities, aiding in creating understanding about reasons for SWP and their role in implementation.	17
Technical capacity was raised for those on the source protection committees via educational resources, presentations and co-learning.	14
Indicators of Absence	**No. of Interviews Confirming Indicator**
Some municipal staff and elected officials do not have the expertise to understand the need for SWP, making re-education programs imperative.	10
There were some issues with the technical guidelines (e.g., tables of drinking water threats, vulnerability ratings, and capture zone delineations).	10
As provincial funding declines so does the maintenance of technical/human capacity. The lack of guaranteed future funding for continual evaluation and monitoring of local circumstance is a concern, particularly in order to keep data and policies up to date in regard to current and future threats.	7

Though this statement relates to financial capacity constraints as well, the decrease in provincial funding has resulted in decreased technical staff at the conservation authorities. As mentioned previously some conservation authorities noted that they had kept staff on to work on other projects, however this could not be done for all staff. Even if more funding was available for further planning and implementation efforts, important

institutional knowledge has now been lost, as those original staff members have gone on to different organizations. One source protection committee member noted it will be more difficult for conservation authorities such as the North Bay-Mattawa Conservation Authority, who are smaller and do not have staff at nearby conservation authorities to collaborate with.

Learning opportunities and the building of technical capacity during the planning process was high. As previously explained there was a significant amount of technical training devoted to the source protection committee members. Fourteen participants noted technical capacity being raised for those on the source protection committees via educational resources, presentations and co-learning (Table 3.7). Furthermore, working groups were created during the planning process. These working groups included source protection committee members as well as additional municipal representatives and others who would be eventually impacted by policy decisions. Presentations on certain topics of interest were also given at the source protection committee meetings as well as the working group meetings. Varied skillsets and expertise (academics, environmental lawyers, activists, etc.) allowed source protection committee members to learn from each other. However, it was noted that committee members could be overwhelmed by the amount of technical information that they were required to absorb. A conservation authority staff member explained, "*even technical staff were challenged with the amount of information we had to go through*" (CA Participant). Agricultural representatives were provided with additional training and support by the Ontario Farm Environmental Coalition, Ontario Federation of Agriculture, and Ontario Ministry of Agriculture, Food

and Rural Affairs. Three participants noted this additional aid to agricultural representatives as beneficial. For example, in the NBMSPA there was a technical dispute related to a potential agricultural threat where the Ontario Farm Environmental Coalition provided data and expertise in support of their agricultural representative. Furthermore, the function of the Ministry of the Environment and Climate Change liaison was noted by two participants as important in providing technical capacity to source protection committees, as well as creating a link to other provincial ministries such as the Ministry of Natural Resources and Forestry, Ontario Ministry of Agriculture, Food and Rural Affairs, and the Ministry of Transportation.

The process under the CWA was effective for educating municipalities and getting them prepared for their role in implementation. However, more ongoing education needs to be in place. Ten informants noted municipal staff and elected officials' understandings of the need for SWP could be a potential barrier to implementation (Table 7). This is especially the case if re-education of municipal staff and elected officials does not occur in the future. Three participants indicated, due to the nature of the four-year cycle of elected government, it has to be an ongoing effort to ensure municipal actors understand the reasons for these policies. A source protection committee member explained,

> *You cannot make assumptions about the capacity and expertise and knowledge of individual municipalities as a static, as a given. Municipalities come in all different sizes, over time people retire, people move on, elected officials move on. New people come in and we don't know what their backgrounds are. So, there will be this constant rebuilding of knowledge and history as people move out and new people take their place. Elected, administrative, and even in the communities themselves* (SPC Participant).

Municipalities, especially smaller ones lacking internal expertise, may not always understand the science behind the source protection plan and related policies. While 20 participants agreed municipalities do understand their role in implementation (see Section 3.1), the ongoing re-education of newly elected officials and municipal staff is critical. Notably, the risk management officials, who enforce policies under the source protection plans, have gone through significant training. Risk management officials (often municipal employees but sometimes this role has been deferred to the conservation authority) continue to work with consultants and provincial staff in interpreting guidelines. The risk management official also serves as an interpreter to municipal staff and elected officials in SWP under the CWA.

In regard to access to adequate data for SWP, data gathered for the assessment reports have derived important baseline information for the regions involved, and this has been an important benefit of the planning process. It was noted by 24 participants that the data created and shared during the creation of the assessment reports increased technical capacity, especially for rural municipalities (Table 3.7). There are now studies to inform decisions. Though, as mentioned, data sharing was effective between provincial ministries, two participants noted that structures are needed for more formal and strategic data sharing in regard to source water supplies. Increased staff at the conservation authority level would also be needed to implement a collaborative data-sharing program. Technical guidelines that contributed to the making of policies in the source protection plans, such as the Tables of Drinking Water Threats and guidelines for how to assess vulnerability and classify intakes and wells, were valuable for creating consistent,

transparent and technically defensible policies. However, 10 participants noted issues with the technical guidelines (e.g., Tables of Drinking Water Threats, vulnerability ratings, and capture zone delineations) (Table 3.7). The prescriptive nature of the technical guidelines sometimes made it hard to apply to local circumstance. Both case study regions wanted to expand beyond the prescribed list of threats, for example, in areas such as threats for Lake Ontario intakes, threats related to clusters of private drinking water wells, and threats related to pipelines. Seven participants also noted limitations regarding the rigidness of capture zone delineations based on groundwater model simulations. A consultant involved in the process explained,

> *The concern lies in how much faith we put into the results of the model. Models can create lines on a map that non-modellers will adopt as fact and may then create real world rules (i.e., planning decisions) based on the position of a line (a time of travel capture zone) that itself is only a generalization, and quite possibly an educated guess at best* (Other Participant).

One risk management official explained that some consultants conducting modelling for the assessment reports were not aware of how models would be used in the whole process. It is clear throughout the planning process, the focus was on intake protection zones, versus watershed protection. One source protection committee member explains,

> *The only thing, [a] limitation would be the fact that the reports, after you did the characterization report, everything started to focus only on drinking water intake zones, which really rammed us back to prior to the Clean Water Act. I mean we have always been looking at intake zones, so, we haven't really moved into a watershed [plan]* (SPC Participant).

In the end, though this first round of planning was essential for building technical capacity for SWP, it did not always allow for all locally specific issues to be addressed. Therefore, there is need for further evaluations of threats. For example, one area of concern expressed by 10 participants in regard to future threats to be evaluated was the impact of climate change on source water supplies. Conservation authorities are tasked in annual reviews and creating new work plans, and can apply to the Minister for further inquiry into specific topics of interest. There is a need to keep the science and policies in the source protection plans up to date. Seven participants indicated that as provincial funding declines to the source protection program so does the maintenance of the built technical/human capacity (Table 3.7). SWP cannot succeed if plans are stagnant. Technical and human capacity to undertake technical studies must be maintained to adequately protect source water supplies now and into the future.

3.4. Discussion

The building of SWP capacity under the CWA has been very strong throughout the process. The legislated process has effectively built capacity in municipalities, especially in those rural municipalities that lack capacity internally and benefit from such regional and/or collaborative programs. The process brought stakeholders and actors together at a watershed level to discuss drinking water protection, something in some cases that had not been done before. There is much that other rural Canadian jurisdictions can learn from this process. First, it is clear that enforceable legislation is critical for ensuring SWP policies are implemented. However, the legislation must strike a balance of providing adequate power for enforcement and consistency while allowing for locally relevant

policy options. In addition, having the program and technical guidelines clearly scoped before the process begins reduces inefficiencies and frustrations with the process. The 2016 Ontario Auditor General's report criticizes the process for taking nearly 17 years after the Walkerton tragedy to create source protection plans. Reasons noted by the Auditor General for this lengthy process include the Ministry's lack of a clear time frame for plan approval and that some plans submitted were deemed incomplete (Ontario Auditor General, 2016). In the wake of the Walkerton tragedy, the program was understandably rolled out in haste, making the entire process essentially a provincial wide pilot project that is continuing to evolve. The 2014 and 2016 Ontario Auditor General reports note several weaknesses in the source protection plans themselves: the plans did not address all potential threats (e.g., spills from industrial and commercial facilities to drinking water intakes in the Great Lakes); plans do not protect those on private wells or single resident intakes (over 1.6 million Ontarians); and plans did not address risks of abandoned wells to groundwater. There were also issues flagged regarding non-compliance with the *Nutrient Management Act*, and the Ministry's weak enforcement of this *Act*. It is noted in the 2016 Auditor General report that the Ministry of the Environment and Climate Change is making progress on these issues (Ontario Auditor General, 2016). However, the source protection plans were created assuming other SWP related legislation, such as the *Nutrient Management Act*, were being properly implemented and enforced. As described, source protection committees focused on creating policies where there were current gaps in legislation and regulatory controls. The incidences of non-compliance with the *Nutrient Management Act* may mean there are gaps in the source protection plans for addressing threats related to nutrients. Ensuring

that the institutional effectiveness of the CWA and the source protection plans are maintained will require constant monitoring and evaluations of the plans. In addition, though some First Nation communities were elevated into their region's source protection plan in other parts of the province, there are still barriers to First Nations involvement. These barriers need to be addressed in a meaningful way. Hanrahan (2017) explained that addressing water security for Indigenous peoples requires, "… an open discussion of Canadian national identity with all its dimensions considered, including colonialism, and a maturation of Canadian liberal democracy to include Indigeneity and Indigenous rights" (Hanrahan, 2017, p. 84). The involvement of First Nation communities in SWP under the CWA requires better efforts and a different approach than has been employed in this first phase of planning. There was indication from provincial participants that this issue is being given serious consideration in the next phase of planning.

Thus far, financial capacity has been sufficient; however, the unknown mechanisms for sustainable funding have affected SWP decisions. The intention of the program was for shared SWP responsibilities, including financial obligations of implementation. Financial ownership by municipalities, especially rural municipalities, is lacking. Conservation authorities, acting as the source protection authorities, worked well in the Ontario context. They were noted repeatedly as the source of technical and social capacity for rural municipalities. But conservation authorities rely on municipal funding for survival. Conservation authorities will require further funding from provincial and municipal sources to maintain their current role in SWP under the CWA, so they do not continue to lose capacity to serve local municipalities. Currently, the Ministry of the Environment

and Climate Change lacks a long term fiscal strategy to ensure municipalities and conservation authorities are adequately funded for source protection plan implementation and maintenance (Ontario Auditor General, 2016). Unfortunately, the nature of government means that funding is at the whim of the political will of the day. More strategic financial plans and fiscal frameworks are needed to ensure funding is continued for SWP. Municipalities also have the responsibility of ensuring that this occurs. However, maintaining sustainable funding sources is particularly difficult for rural municipalities. Especially for rural municipalities, future fiscal frameworks need to be thoughtfully considered. Financial concerns continue to be one of the greatest roadblocks in implementation of SWP, as seen in the community of Trout Creek who opted out of the process under the CWA after realizing the financial consequences of potential policies. Furthermore, current source protection plans and policies will lose effectiveness if not continually updated and supported by enforcements tools (e.g., legislation, regulations, local zoning and by-laws, and the human resources to enact enforcement). Guaranteed financial capacity for continued support of risk management officials and continued implementation (e.g., septic system inspections currently being conducted by conservation authority staff) has been questioned. The 2014 and 2016 Ontario Auditor General report states that Ontario has low cost recovery rates for industrial and commercial facilities that take water. This was due to low fees paid by limited companies ($3.71 for every million litres they drew) (Ontario Auditor General, 2016). The valuing of water needs to increase if we want to create operational fiscal frameworks to adequately pay for SWP as well as other drinking water related expenses. Since the release of the 2016 Ontario Auditor General report, there has been some progress in the valuing of

water. As of 1 August 2017 Ontario will raise fees to $503.71 for every million litres of groundwater taken. Furthermore, the Minister of Environment and Climate Change announced a moratorium on new or expanding water takings by bottling companies until 1 January 2019 (CBC, 2017). Ultimately, institutional measures such as legislation and governance structures need to be matched with fiscal frameworks to support these structures. Finding efficiencies in regional collaborations could offer promise for rural municipalities (Minnes & Vodden, 2017).

SWP poses complex problems in implementation and requires the integration of expert science, local knowledge, community beliefs and values (Simpson & de Loë, 2014; Simpson, de Loë & Andrey, 2015). Legislation alone is useless unless those required to enact it commit to doing so. Fostering this type of commitment requires the building of social capacity. It is clear that social capacity was built during the creation of the source protection plans. The process under the CWA brought together diverse stakeholders through various methods including the source protection committees and public engagement events to create the source protection plans. However, it was noted that engagement techniques could be more creative in order to eliminate barriers to engagement, such as long travel distances to events (Huck, 2012). This is particularly a concern in rural areas with large spread out geographies. The creation of lay summaries of the plan and accessible information is important. Participants involved in the SWP planning process hoped that this type of public outreach will continue, but some doubted whether the current level of enthusiasm can be sustained. It was the general sentiment of informants that if people turn on their water and it is safe and clean, then they stop caring

about the need for SWP actions. However, "SWP has no clear end-point, it requires ongoing societal involvement" (Simpson & de Loë, 2014, p. 228). Just because there is no perceived or current issue with drinking water, that does not mean there cannot be an issue in the future. The nature of water and the environment in general is that it is constantly changing and evolving, and so are threats to drinking water. Threat identification and mechanisms for mitigation should be a collaborative effort (Ananda & Proctor, 2013; Emerson et al., 2012). Especially in rural areas, landowners and the general public are required to implement SWP through actions in ways such as reducing fertilizer use and ensuring septic systems within contributing areas are properly maintained. People need to be continually reminded of the importance of SWP, and their role in it. How public engagement in the process occurs should be re-evaluated so that citizens continue to be active participants in SWP. It is important that engagement is not just simply done, but is effective. Further ongoing work is needed to continue to increase and maintain social capacity for SWP in the case study regions. Help from non-governmental organizations in engagement efforts could aid in diversifying engagement techniques and participating audiences.

Technical and human capacity was raised significantly during this process through extensive education and training, data sharing and increases in human resources devoted to SWP. The education and time invested in decision makers (those on source protection committees) as well as implementers (such as the risk management officials) has been immense. Notably, the support and training of agricultural representatives by the Ontario Farm Environmental Coalition SWP working group has built capacity with these

important stakeholders (Simpson, 2014). Other studies have shown that information sharing was valuable during the visioning and early stages of policy development and it increased efficiencies and consistency throughout the province. Having structures in place where these types of information sharing and co-learning can occur will be increasingly important as monitoring, evaluations, and amending of source protection plans occur (Murray & de Loë, 2013). It was noted that conservation authorities, like the North Bay-Mattawa Conservation Authority, who do not neighbour another conservation authority, might be at a disadvantage, as they lack the opportunity to collaborate on certain technical endeavours. Ways to connect conservation authorities with other SWP partners will continue to be important, and may require more formal collaboration (e.g., structured data sharing programs) to continue. Furthermore, ongoing education of all involved in implementation must continue to occur, specifically for elected officials at the local level who go through constant four-year turnovers. Additionally, more evaluation of local circumstances and support for keeping data and policies up to date is required. Murray and Roth (2012) also found that SWP requires adaptive approaches that embed evaluation to adequately address current and potential threats (Murray & Roth, 2012). Adaptive approaches are difficult, however, if funding for monitoring, evaluation, future planning and continued implementation is unknown. Recent studies have shown that engaging the public in community-based water monitoring can be a viable option when government funding declines. However, these types of programs still need to be provided with adequate financial, institutional, social and technical/human capacity to succeed (Garda, Castleden & Conrad, 2017). Human capacity has already been diminished from its original level in the preliminary phases of the creation of the source protection plans.

Maintaining current levels of technical/human capacity will be difficult, especially if provincial funding for the program continues to decline.

3.5.Conclusions

Ultimately, the SWP process under the CWA has been successful for building capacity for SWP in the rural municipalities that were included under the protection of the *Act* (i.e., those with municipally operated drinking water systems). This research found that SWP in rural areas needs: enforceable mandatory legislation; sustainable provincial funding and municipal fiscal frameworks to support ongoing SWP planning and implementation; technical aid at the regional level (e.g., CA); and support and commitment to SWP at the local level (e.g., municipalities, local health units, landowners, residents and watershed users). It was suggested by participants that if other places in rural Canada were to adopt a similar type process, they would have to critically select the aspects of the program that would be appropriate for their local context. This coincides with other research suggesting that proper SWP policy transfer needs to have "consideration of the political and institutional, resources and capacity, cultural, and biophysical contexts of the original and receiving jurisdictions" (de Loë & Murray, 2013, p. 95).

A question arising from this research is whether the SWP capacity built in Ontario is sustainable? There are considerable concerns about where this program will go from here, and what will be the result if municipalities (especially already fiscally limited rural municipalities) are required to pay for all ongoing implementation. Through this process,

it was indicated that municipalities deliberatively made policies with financial restrictions in mind, such as imposing outreach and education policies rather than policies that may require a risk management official to oversee. However, will this ensure safe drinking water supplies for rural residents in the future? Is that part of the needed compromise of SWP, or have these financial restrictions diluted the potency of the plans and their policies in protecting drinking water sources? The next iterations of these plans and further clarifications of the CWA will have significant implications for rural Ontario. Will it include those other areas part of the rural landscape such as First Nations reserves, those on private wells or those municipalities located outside of a conservation authority boundary? As exemplified by the attempt to elevate the community of Trout Creek's private well cluster into the NBMSPA's plan, the current process cannot be directly transferred to privately-serviced rural areas (discussed further in Chapter 4). Further research is required on the best ways to include private and First Nation drinking water systems into the CWA to ensure those residents reliant on these systems have adequate drinking water protection. Collaborative frameworks, such as the one under the CWA, offer promise, and have indeed raised SWP capacity for the rural municipalities involved. However, Ontario cannot become complacent with its admirable SWP efforts. Source protection plans are not meant to sit on a shelf. They should be living documents that are constantly implemented through local and provincial planning decisions, landowner actions, and citizen behaviours. Funding to keep these plans alive and vital (e.g., containing up-to-date science, implemented by necessary actors, inclusive of all drinking water systems) is evidently still an unresolved topic for future debate.

Acknowledgments: This research would not be possible without the generous support of the MITACS-internship program, The Harris Centre- RBC Water Research and Outreach Fund, and the Rural Policy Learning Commons. Thank you to my supervisors Kelly Vodden, Maura Hanrahan and Robert Scott for their continual guidance and support of this research. In addition, thank you to all the participants in this research project for their generous donation of their time and expertise.

Conflicts of Interest: The author declares no conflict of interest. The funding sponsors had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, and in the decision to publish the results.

3.6.Appendix

Table A3.1. Elements of Capacity for SWP*

Element	Definitions and Example Indicators

Institutional	The legislation, regulations, policies, protocols, governance arrangements and delegation of responsibility to plan and enact SWP. Example indicators include: • Provincial legislation and policies provide guidance for drinking water protection at the local level • Municipal planning strategies and by-laws protect current drinking water supplies • Land use activities are controlled in municipal well field, recharge and watershed water supply areas • Land has been purchased for the protection of current municipal water supplies • Plans have been developed to guide municipal actions during water quality emergencies • All responsible for SWP know their responsibilities for implementation and enforcement • Institutional arrangements for land water management is integrated • Local land use planning supports SWP at a watershed or regional level
Financial	The ability to acquire adequate funds to pay for SWP efforts as well as for ongoing planning, governance and management efforts. Example indicators include: • Organizations responsible for protecting source water supplies are able to maintain a balanced budget • Organizations responsible for protecting source water supplies are able to obtain funding from outside sources • Water rates for customers reflect the full cost of protecting and providing municipal drinking water (including treatment, distribution, maintenance, and SWP) • Funding is available for municipal SWP projects • Financial mechanisms are used to reduce water use (e.g., water rates charged by municipal water utility are used to reduce water consumption)

Social	The social factors that influence SWP governance and implementation. This includes social norms (e.g., values, attitudes, behaviours, sense of place, trust, reciprocity, commitment and motivation) that impact public awareness, stakeholder involvement, community support, and public and private partnerships in SWP efforts. This also incorporates structural networks, communications and the relationships between different groups interests and actors. Example indicators include: • Clear leadership for water quality protection at the watershed level exists • Active linkages between municipality and provincial agencies exist (vertical linkages) • Active linkages among watershed municipalities exist (horizontal linkages) • Active linkages between municipality and community organizations exist (horizontal linkages) • Community awareness and support for watershed protection
Technical/Human	The physical and operational ability of an organization to perform SWP management and operations adequately. In addition, having the human resources, with adequate knowledge, skills and experience to properly create source protection plans and implement needed measures. Example indicators include organizations responsible for protecting source water supplies have: • Employees dedicated to water management • Access to individuals with the necessary skills and training to manage drinking water • Education and training opportunities available to staff members and decision makers • Access to individuals with the expertise needed to undertake technical activities related to drinking water quality • Access to the data needed to manage water supplies, delineate watersheds and aquifers, and develop source protection plans

Note: * Indicators based on: (Ivey et al., 2006; Noble & Basnet, 2015; Rawlyk & Patrick, 2013; Robins, 2008; Timmer, de Loë, & Kreutzwiser, 2007)

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4. Capacity for Source Water Protection in Ontario's Privately-Serviced Rural Areas

By: Sarah Minnes and Hugh Simpson

Abstract

This research examined the capacity for source water protection (SWP) of privately-serviced rural areas in Ontario. SWP for particularly privately-serviced areas has been identified as a gap in existing research and policy in Ontario. Privately-serviced areas refer to communities where households and public buildings either fully or partially derive their drinking water from private water systems (e.g. private wells), which fall outside of a municipal drinking water system. Capacity for SWP in these areas was explored through a capacity framework consisting of the following elements of capacity: technical/human, financial, social, and institutional (Ivey, de Loë, Kreutzwiser, et al., 2006; Minnes, 2017; Noble & Basnet, 2015; Rawlyk & Patrick, 2013; Robins, 2008; Timmer et al., 2007). A case study approach was employed using the Cataraqui Source Protection Area and the North Bay-Mattawa Source Protection Area. Thirty key informant interviews were conducted and analyzed, together with document review, policy analysis, and member checking. It was found that privately-serviced rural communities often do not see the protection of drinking water as one of their mandated responsibilities and that there are legislative gaps as well as technical/human, social, and financial capacity gaps for undertaking SWP in privately-serviced areas. Further investigation is needed into options for a new, integrated, implementable and context

appropriate SWP framework for privately-serviced areas in rural Ontario.

Keywords: source water protection, rural water, Ontario, capacity

4.1.Introduction

There are approximately 1.6 million Ontario residents who rely on private wells for their drinking water (Ontario Auditor General, 2016). In Canada, those served by private drinking water systems, including private wells, may have a greater likelihood of waterborne illness than those residents served by municipally operated (i.e. public) drinking water systems (Murphy, Thomas, Schmidt, and Medeiros, 2016). Given that the majority of people serviced by private systems live in rural areas (Simpson, 2004), concerns associated with private well supplies are primarily, although not exclusively, a rural issue.

Source water protection (SWP) is an important first step in the multi-barrier approach for the protection of drinking water supplies (O'Connor, 2000; Ministry of the Environment, 2004). In Ontario, there is a highly prescribed approach for protecting municipal and communal drinking water supplies under the authority of the *Safe Drinking Water Act (S.O. 2002, Chapter 32)* and the *Clean Water Act, 2006, S.O. 2006, c. 22* (CWA) (Ontario Government, 2002; Ontario Ministry of Environment, 2006). No similar comprehensive regulatory approach exists for protecting private water supplies, although targeted voluntary programs have been developed, namely for farm and some rural wells (i.e., cottages) (Simpson et al., 2007).

In the absence of proper drinking water treatment and monitoring (for a variety of reasons), SWP is often an important and cost effective approach available to private well owners for protecting private water supplies (Simpson et al., 2007). Outreach and education are important activities for ensuring that rural land owners are aware of and take the appropriate actions to protect their drinking water supply. Unfortunately, government activities to promote private water well protection is, "…limited by complacency, inconvenience, cost and privacy concerns, identified consistently by those examining stewardship behaviour of private well owners in Newfoundland, Ontario, and across Canada" (Murphy et al., 2016, p.1365).

The purpose of this paper is to use a capacity framework to evaluate if privately-serviced rural municipalities in Ontario have the capacity for SWP. Capacity for SWP in privately-serviced areas is conceptualized here as encompassing four main elements: technical/human capacity, financial capacity, social capacity and institutional capacity (Ivey et al., 2006; Minnes, 2017; Noble & Basnet, 2015; Rawlyk & Patrick, 2013; Robins, 2008; Timmer et al., 2007) (a summary of details and indicators of these four different capacities is provided in Table A4.1). In this context, privately-serviced areas include communities in which households and public buildings derive their drinking water from private water systems and are not connected to a municipal drinking water system. When considering specifically rural drinking water in Ontario, the most common source of water is groundwater fed private wells (Simpson, 2004). Although it was recognized that some rural residents are served by private surface water supplies, the

focus of this article is the capacity of rural communities in Ontario to implement SWP for private wells.

4.1.1. Protection of Private Wells

The safe operation of private wells in Ontario is the responsibility of the well owner (Murphy et al., 2016). This responsibility includes ensuring that a private well does not become a conduit for contaminants that would impair groundwater quality in the underlying aquifer that supplies the well and neighbouring wells (Richards, Miller, & Green, 2013). The threat posed by contaminants, and associated risks to both the environment and human health (e.g., bacteria, protozoan, and viruses causing diseases or illnesses), can be mitigated through SWP efforts (Simpson et al., 2007).

A recent review of legislative tools for well safety found that in Ontario, private wells "… have not benefitted from the same safety improvements as municipal systems, and concerns persist that gaps in regulating wells leave some Ontarians exposed to health and environmental risk" (Environmental Commissioner of Ontario, 2017, p. 32). However, there are legislative tools in Ontario that can support SWP for private wells. Regulation 903 (Wells), under the authority of the *Ontario Water Resources Act, 1990, R.S.O. 1990, c. O.40* (OWRA) deals with wells directly and provides protection by stipulating requirements for construction, maintenance and decommissioning, and licensing of well contractors (Government of Ontario, 1990).

There is also a suite of other legislative and regulatory tools that can provide protection of

private water wells and the associated groundwater resources. For instance, an opportunity exists under the provisions of the CWA (Ontario Ministry of Environment, 2006) for privately-serviced systems to be 'elevated' and be considered equivalent to municipal systems, through municipal council resolution, in order to benefit from the planning and protective measures available through the Source Protection Planning process. Other legislative tools, such as the *Planning Act, Greenbelt Act*, and the *Oak Ridges Moraine Act*, provide the authority to municipalities to establish planning controls and by-laws that will provide protection to areas containing privately-serviced systems. Some examples include: policies requiring assessment and monitoring of source water supplies for privately-serviced areas; land use restrictions to minimize identified threats to vulnerable areas, including by-laws that regulate control, or ban the use of pesticides; and policies requiring assessment and monitoring associated with the development of new subdivisions serviced by private water supplies (Central Lake Ontario Conservation Authority and Jagger Hims Limited, 2008, p. 46).

However, the use of planning controls or by-law controls related to private wells are inconsistent throughout the province. The ability of municipalities to enact the above policies and/or planning instruments varies and is dependent on various capacities present, as well as the awareness of, and political will to use, these regulatory controls.

4.1.2. Rural Source Water Protection and Capacity

Neoliberal approaches to water governance in Canada that download water responsibilities to the local level (Cohen, 2012) have further challenged rural

communities in meeting their responsibilities for drinking water management. Rural communities face unique challenges in enacting SWP for their residents, including limited tax bases to finance such efforts and a lack of awareness of the need for SWP along others (Eledi, Minnes, & Vodden, 2017; Minnes & Vodden, 2017). For privately-serviced rural municipalities in Ontario, additional issues with capacity exist. In municipalities that have privately-serviced areas, drinking water is usually not seen as a municipal responsibility, and the municipality may or may not have regional support (such as a conservation authority) to provide technical aid in SWP efforts. The lack of leadership from the municipal or regional level for SWP in privately-serviced areas can become a barrier to implementation of SWP efforts at the watershed or wellhead level (Simpson & Myslik, 2005; Simpson et al., 2007).

SWP can be implemented using either a regulatory or voluntary approach, but both require planning and educational resources, and ideally financial incentives, to be successful (Kreutzwiser et al., 2011). Previous research has found that a risk-based Private Wellhead Protection Plan can be an important part of SWP in privately-serviced areas (Simpson & Myslik, 2005). Regardless of the SWP approach used – regulatory, voluntary, or some hybrid thereof – the desired outcome is a recognition by well owners that there is a need to minimize threats on their property to their well water supply. If there is wide enough uptake of SWP at the property level, this will also provide a cumulative level of protection for groundwater recharge areas serving the broader populations (Simpson et al., 2007; Richards, Miller, & Green, 2013).

Development and implementation of a SWP program for privately-serviced areas would require a significant amount of capacity, however. The absence of a formal program for promoting SWP in privately-serviced areas in Ontario suggests that there may not be the same capacity for private wells protection compared with municipal and communal water systems. The research presented in this paper further examined this potential concern.

4.2. Methods

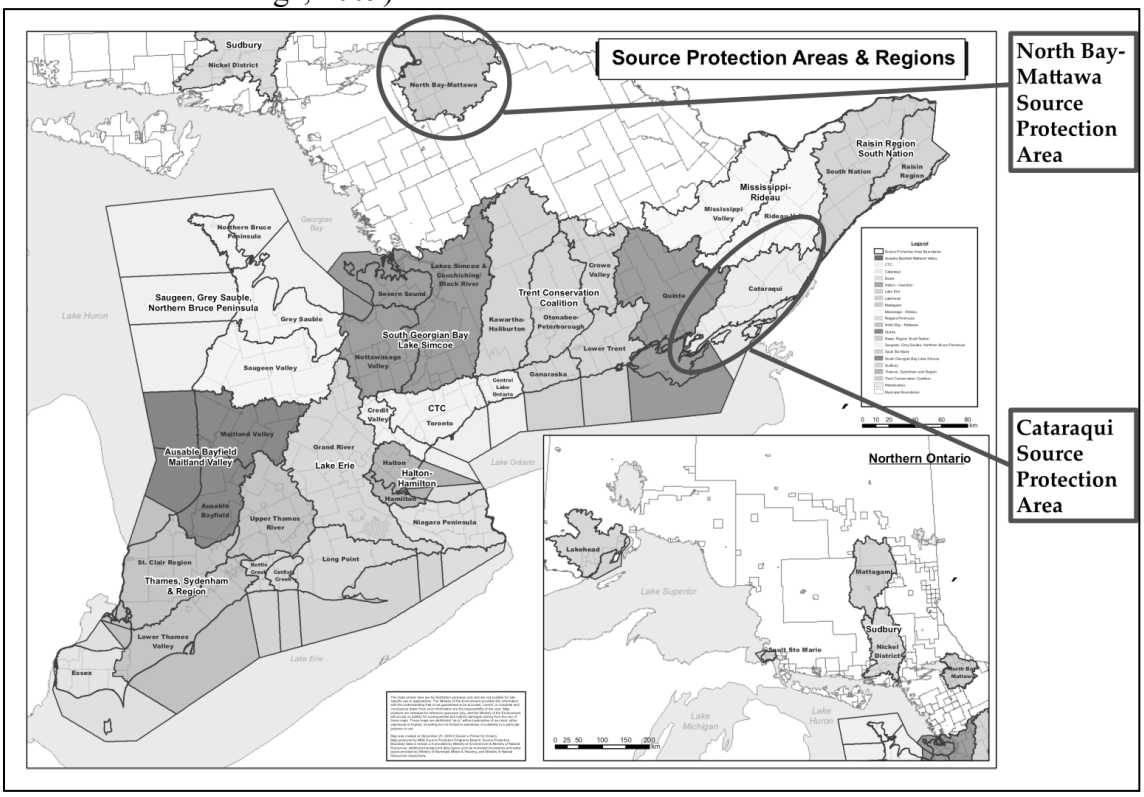
This research used a case study approach (Yin, 2011) using two source protection areas in Ontario, defined under the CWA. These source protection areas were the Cataraqui Source Protection Area (CSPA) located in eastern, Ontario and the North Bay-Mattawa Source Protection Area (NBMSPA) located in 'near north' Ontario (see Figure 4.1). Both regions had a strong presence of rural and small-town communities, including communities with private water supplies. This research used the all-encompassing definition of rural adopted by the Ontario Ministry of Agriculture, Food and Rural Affairs. This definition considers rural as all Statistics Canada census subdivisions (including lower tier and single tier municipalities) that meet at least one of the following criteria, as per the latest Census of Population: have a population of less than 100,000 people, and/or have a population density of 100 people/km^2 or less (Ontario Ministry of Agriculture Food and Rural Affairs, 2017).

Using this definition, every municipality in the case study regions would be considered rural, except for Kingston, Ontario in the CSPA (Statistics Canada, 2018).

This research is grounded on a significant literature review that was undertaken to

understand the legislation, regulation, policies and programs related to the protection of private wells in Ontario, as well as issues and opportunities in relation to SWP for these areas. Resulting from this literature review the capacity framework for SWP presented by Rawlyk and Patrick (2013) was further refined. Definitions and indicators of capacity for SWP (see Table A4.1 below) contributed to the interview guide used for semi-structured interviews and codes used for the analysis of the interview transcripts. This research contributed to a doctoral degree research project examining SWP in both serviced and privately-serviced rural communities. Therefore, some of the indicators in Table A4.1 are more relevant to serviced areas. However, efforts were made to adjust indicators for the analysis of privately-serviced areas. Findings of this research have also been supported by document analyses of Ontario's drinking water legislation, regulations, policies and programs and other related documents such as websites and source protection committee meeting minutes.

Figure 4.1. Case Study Locations (Ontario Ministry of the Environment and Climate Change, 2009)



4.2.1. Semi-Structured Key-Informant Interviews

Thirty-one key informant interviews were conducted, with various stakeholders in both case study regions as well as experts with a provincial perspective. One key informant decided to withdraw their information from the study, resulting in 30 interviews being used in analysis (see Table 4.1). Key informants were targeted based on their familiarity with the rural context in Ontario as well as their role within the source protection planning and implementation process. Semi-structured interviews were conducted using two interview guides (depending if the participant was a provincial government/provincial wide informant or a regional informant). The interview guides

contained questions related to various topics, including questions evaluating elements of capacity for SWP (See Table A4.1). These qualitative semi-structured interview guides facilitated two way interactions and allowed for investigation of complex issues from the participants' perspective (Yin, 2011).

Table 4.1. Key Informant Interviews Analyzed (n=30)

Sector	**Identifier in Article**	**Total**	**CSPA**	**NBMSPA**	**Ontario-Wide**
Source protection committee member	SPC Participant[5]	9	4	5	0
Provincial staff	Provincial Participant	4	3	1	0
Upper/lower tiered municipal staff and elected officials	Municipal Participant	8	4	4	0
Conservation authority/Conservation Ontario staff	CA Participant	5	2	1	2
Non-governmental expert or consultant	Other Participant	4	0	1	3
Total		30	13	12	5

4.2.2. Analysis

The initial analysis of key informant interviews was conducted using predetermined indicators (Table A4.1) to code interview transcripts (or in one case interview notes). Coding was conducted using NVivo qualitative research software. First, transcripts were coded generally according to each element identified in Table A4.1. After general coding

[5] Source protection committee members interviewed represented a range of affiliations including actors from agriculture, business, municipal, academic, and public health sectors.

was conducted, indicators were further sorted depending if the reference exemplified either the presence or absence of the element for capacity for SWP in privately-serviced areas (Table 4.2). Further coding was done to determine key findings. If three or more participants (10% of the sample) noted the same indicator, this was coded as a key finding, and the number of interviews confirming each indicator was tracked. Further analysis of identified key findings (outlined in Tables 4.3-4.6), delved into the evidence and derived conclusions from both the percentages and the raw qualitative data.

Member checking was also employed with key informants to ensure the researcher properly understood the derived findings. Member checking, also called "ground truthing" is a research method for exploring the validity of results. It involves providing results back to participants to gain feedback on the accuracy of the findings according to the participants' own experience (Birt, Scott, Cavers, Campbell, & Walter, 2016). This was done in three ways: 1) follow up meetings with select participants; 2) asking for quote approvals/clarification for some informants; 3) creating a knowledge brief on the key findings of the paper and preliminary recommendations. Each participant was given just over one month to respond to this summary document. Feedback informed the final findings and conclusions of this research.

4.3.Results and Discussion

Overall results are displayed in Table 4.2, which outlines the percentage of participants in each region that either indicated the presence or absence of the element of capacity for SWP for privately-serviced areas, at least once during their interview. Further analysis of

these results is outlined in Sections 4.3.1-4.3.4.

Table 4.2. Interviews Indicating a Presence and/or Absence of Elements of Capacity

Technical/Human			**Financial**			**Social**			**Institutional**		
	+	−		+	−		+	−		+	−
C (*n*=12)	75%	67%	**C (*n*=10)**	70%	60%	**C (*n*=9)**	67%	67%	**C (*n*=13)**	54%	77%
NB (*n*=11)	45%	73%	**NB (*n*=9)**	11%	100%	**NB (*n*=9)**	44%	89%	**NB (*n*=11)**	55%	100%
O (*n*=5)	80%	80%	**O (*n*=5)**	0%	80%	**O (*n*=3)**	33%	67%	**O (*n*=5)**	80%	100%

+ = Presence; − = Absence; C = CSPA; NB = NBMSPA; O = Ontario Wide; *n* = The number of interviews that discussed the element per region.

4.3.1. Technical/Human

Table 4.3. Key Findings for Technical/Human Capacity

Indicators of Presence	**No. of Interviews Confirming Indicator**	**Percentage of Interviews (n=28)**
There are provincial legislation and regulations that have either purposefully or inadvertently raised technical capacity for SWP in privately-serviced areas.	16	57%
There are examples of municipalities who are educated and proactive about SWP in their privately-serviced areas.	4	14%
Indicators of Absence	**No. of Interviews Confirming Indicator**	**Percentage of Interviews (n=28)**
There were concerns about the ability of the human capacity in privately-serviced areas to adequately implement SWP.	13	46%
Modelling and technical approaches for determining vulnerable areas for clusters of wells elevated into the source protection plans under the CWA are still in progress.	12	43%

There is a noted lack of availability of groundwater data for privately-serviced areas and a need for further studies to be conducted.	9	32%

n = The number of total interviews that discussed the element.

Technical/human capacity provides the operational ability to plan and implement SWP for a water system. To properly plan for and enact SWP there is a need for access to the data required to delineate watersheds and aquifers and to manage water supplies (Minnes, 2017; Rawlyk & Patrick, 2013; Robins, 2008). SWP efforts also require the human resources with the knowledge, experience and skills to create source protection plans and implement SWP measures (Rawlyk & Patrick, 2013; Robins, 2008). In the case of privately-serviced areas, each private system owner is responsible for planning and implementing SWP measures for their system, and are therefore key human resources. As described in Section 4.1.1, some obligations are also entrusted to municipalities through planning controls and by-laws, and to well drillers through Wells Regulation 903 under the OWRA. Municipalities can also play a role in providing data and educational support to well owners, and therefore be important sources of technical/human capacity for private well owners.

In total 28/30 participants addressed technical/human capacity for privately-serviced areas (Table 4.3). There was variability between the regions, with the presence of technical/human capacity more prominently outlined by CSPA (75%) and Ontario-wide (80%) participants (Table 4.2). In contrast, fewer than half the participants who addressed technical/human capacity in the NBMSPA (45%) indicated the presence of

technical/human capacity (Table 4.2). Sixteen participants (57%) stressed the point that provincial legislation and policies exist that either purposefully or inadvertently increase technical capacity for SWP in privately-serviced areas (Table 4.3). For example, the CWA improved available data for privately-serviced areas through the assessment work conducted in the source protection regions. This included regional groundwater studies undertaken in the CSPA that have implications for privately-serviced areas. There was also a pilot technical study undertaken to delineate vulnerable areas for clusters of wells in the NBMSPA, as part of the source protection planning process under the CWA. The study used five privately-serviced hamlet communities in the NBMSPA that rely on clusters of individual wells. In order to inform municipal officials and residents living in vulnerable areas, the study used time of travel assessments and available water well records, geological mapping, and groundwater contouring methods to determine well head protection zones (Richards, Miller, & Green, 2013).

Under the CWA, Source Protection Committees created watershed-based source protection plans. These plans contained both binding and non-binding policies. Non-binding policies often encouraged technical capacity building in privately-serviced areas in order to implement SWP for public drinking water systems. For example, in the CSPA it was explained,

> *There's a policy in the plan that encourages the Ministries of Municipal Affairs and Housing and the Environment and Climate Change to reach out to municipal councils and staff where there are extensive areas of highly sensitive groundwater sources to teach them why they are sensitive and what practical planning tools can be used to protect them* (CA Participant).

These types of non-binding policies are voluntary and implementation depends on available human and financial resources. Regulation 903, under the authority of the OWRA was also noted as important for collecting private well data. This regulation stipulates requirements for the construction of water wells, and what records must be created and maintained by well drillers. This act makes the role of the well drillers vital in both drilling wells properly, and tracking where new wells are drilled (Environmental Commissioner of Ontario, 2017). However, this legislation does not track abandoned wells nor wells constructed prior to Regulation 903 coming into effect, which results in a technical capacity gap due to missing data.

Interestingly, participants from all regions indicated an absence of technical/human capacity. This shows the complexity with these types of concepts. For example, nine participants (32%) expressed a lack of availability of groundwater data for privately-serviced areas and a need for studies to be conducted (Table 4.3). This deficiency is important, because the identification of vulnerabilities and threats is vital in order to properly plan source protection efforts (Kreutzwiser, de Loë, & Imgrund, 2010; Krolik et al., 2013; Simpson et al., 2007). This type of information is lacking for most privately-serviced areas. Assessments conducted under the CWA *'s* source protection planning process were limited to wellhead/intake areas for municipal systems and did not include private wells. Generally, specific data on groundwater vulnerabilities is deficient unless private wells happened to be located within a contributing area of a municipal well/intake.

Twelve participants (43%) noted that modelling and other technical approaches for determining vulnerable areas for well clusters (six or more wells or intakes) (Government of Ontario, 2006) are still in progress (Table 4.3). There was an indication that the MOECC is looking further into this issue. One Provincial Participant explained,

> *British Columbia has a great approach right now. Where they have…approaches that you can use for groundwater and delineating where is a sensitive area and where are the risks in there and how you deal with them. And we are looking at that framework to [see] if that is something that we could apply here* (Provincial Participant).

Four participants (14%) described examples of municipalities that are proactive about SWP for privately-serviced areas (Table 4.3). For example, in the town of Callander, located in the NBMSPA, regular septic system pumping was being promoted for every property in their municipality, not just those within an ICA defined under the CWA. However, 13 participants (46%) expressed concern about the knowledge and the abilities the human capacity in privately-serviced areas for implementing SWP (Table 4.3). For example, there is a general lack of human/technical capacity at the municipal level to tackle SWP issues due to the multitude of other issues they have to deal with,

> *In a lot of small municipalities there is a chief cook, bottle washer and by the way he or she gets on the broom to sweep off the parking lot. Or gets up on the grader. It will be those folks that I worry about, it will be those municipalities that I am concerned for because I have seen it, I've lived it. Not just in my individual work career but I have seen as a municipal manager looking at Northern Ontario which is predominantly small, rural, isolated, and there are only a couple of urban centres that have any sort of size and capacity, so it is going to be a real challenge* (SPC Participant).

Furthermore, even if there are human resources at the municipal level, the technical

knowledge of the individual homeowner concerning SWP is imperative since the onus is on them to manage and operate their system. One CA Participant communicated, "*I do think there are some folks in rural communities, that are unaware of what they should be doing to protect their drinking water source. And that's a problem yet to be tackled*". Another participant noted that people coming from urban areas to rural settings do not always understand their responsibilities in looking after their system.

Two informants suggested that highly vulnerable areas should be determined and prioritized for targeted SWP efforts. However, even if data regarding vulnerability is available, interpreting data can be difficult, highlighting the relevance of technical capacity. One informant noted that it is hard to convince people that there is a potential threat to their health through drinking water contamination. Often nothing is perceived to be wrong if no one has been acutely sick. There is a need for further capacity building at the regional, municipal, and household level, to address existing shortcomings with the technical/human capacity of privately-serviced areas.

4.3.2. Financial

Table 4.4. Key Findings for Financial Capacity

Indicators of Presence	**No. of Interviews Confirming Indicator**	**Percentage of Interviews (n=24)**
There have been financial incentives for SWP efforts in privately-serviced areas.	7	29%

Indicators of Absence	No. of Interviews Confirming Indicator	Percentage of Interviews (n=24)
There is fear of financial impacts of SWP at the regional/municipal level.	11	46%
There is an absence of provincial level financial commitments to SWP in privately-serviced areas.	9	38%
There is fear of the financial impacts of SWP at the household level.	8	33%

n = The number of total interviews that discussed the element.

Financial capacity for SWP in privately-serviced areas involves having adequate funds to support ongoing governance, planning, and management efforts (Minnes, 2017; Rawlyk & Patrick, 2013; Robins, 2008). In total, 24/30 (80%) of all participants spoke to financial capacity for privately-serviced areas during their interview (Table 4.4). 70% of participants in the CSPA indicated in their interview a presence of financial supports to undertake SWP in privately-serviced areas (70% of informants) (Table 4.2). However, in the NBMSPA and with the Ontario wide participants, there was very low presence of financial capacity noted within the interview responses (11% in NBMSPA, 0% in the case of the Ontario wide) (Table 4.2).

Seven participants (29%) indicated that there have been financial incentives for SWP in privately-serviced areas (Table 4.4). First, under the CWA some SWP activities for privately-serviced areas were funded through the Ontario Drinking Water Stewardship Program (Government of Ontario, 2017b), if it was determined they would contribute to the protection of a municipal drinking water source. It was explained,

Then there was a targeted [effort] to say if you are in an area where your activity could be a significant risk here is a pot a money that is available and here are the eligible things that you can do [with it]. And all of those things around protecting the [municipal] source of water. Preventative measures. Upgrading wells so they are not conduits down to our aquifers. All of those things. Abandoning wells that are within that catchment area (Provincial Participant).

Overall, the majority of participants that spoke to financial capacity for privately-serviced areas, indicated that there is general lack of funding (60% in CSPA, 100% in NBMSPA, 80% Ontario wide participants) (Table 4.2). This suggests that although there may be some avenues to access financial capacity within the CSPA, the lack of financial capacity remains a barrier for SWP in privately-serviced areas. Although there was availability of some funding, eight participants (33%) expressed concerns of the financial impacts of SWP at the household level (Table 4.4). For instance, mandatory requirements under the Building Code for septic inspection (~$240/system), and the possibility of further stipulations in the future such as requiring advanced systems, resulted in opposition to local SWP efforts for private wells. One participant said residents underreport issues with wells because people are sometimes afraid of the impact that this will have on their house resale value. For example,

The conservation authority wonders, like they say [does] anyone have a problem? Let us know so we can map it and stuff but no one [who] has a well problem wants to tell anybody. Because they want to sell their house someday. They don't want to record anything on record, you know that summer their well ran down (SPC Participant).

There is limited financial capacity at the municipal or regional level to pay for SWP efforts in privately-serviced areas and this generates fears surrounding the financial cost

of SWP efforts at the household level. Eleven participants (46%) identified the limited financial capacity of municipalities as a barrier to SWP in privately-serviced areas (Table 4.4). Privately-serviced areas are located predominantly in rural areas where municipalities have limited tax bases. This is problematic because there is no public funding scheme at this time for privately-serviced water infrastructure in Ontario.

One option for assisting privately-serviced areas in qualifying for public funding is for a municipality to 'elevate' a cluster of private water systems to be designated and treated like a municipal water system under the CWA by passing a council motion. There was a privately-serviced community that was elevated into the NBMSPA's source protection plan, however, in the end the community decided to withdraw from the plan, mainly due to financial issues. It was explained,

> *The fact of the matter was once we realized what was about to happen and people of Trout Creek would have their drinking water, their personal wells, [labelled] a potential hazard…. That would devalue their home so greatly. It was unbelievable. And that was the crux of us trying to get that removed. I mean yes there was more stringent restrictions to the community, [we] would never [be] allowed to have a gas station. We're never allowed to do basically any development in the community. No growth, no nothing. It was just to me, it was mind boggling* (Municipal Participant).

As a consequence, rural municipalities were very hesitant about elevating a cluster into their region's source protection plan. It was explained,

> *Frankly I think because there was a strong sense that there was going to be very little by way of implementation dollars, and there were a lot of unknowns on what the implications would be on rural residents in terms of their land use restrictions, municipal financial obligations and that sort of thing. Unilaterally they were excluded or never put*

forward as a cluster by the municipal representatives (Other Participant).

Overall, nine participants (38%) noted an absence of provincial level financial commitments to SWP in privately-serviced areas (Table 4.4). First, there are no incentives for privately-serviced municipalities to enact non-binding policies included in source protection plans created under the CWA. The funding given during the process under the CWA was focused on those privately-serviced areas located in areas of land that provide groundwater recharge for a municipal drinking water supply that had binding policies associated with them. It was explained,

I think the Province needed to manage the scope the study when it was determined that a) there was already legislation that puts the responsibility for construction, maintenance and decommissioning of privately owned wells on the homeowner and his/her contractor and b) the resources and permissions that would be required to access and address potential contamination for every private well would be exorbitant and impractical. It was determined that the program should focus on municipal supplies as they serve the majority of the population (CA Participant).

Ongoing provincial funding for the implementation of source protection plans under the CWA is uncertain, even for serviced municipalities (Minnes, 2017). Therefore, funding allocated to the protection of privately-serviced areas is not expected by most participants, especially those privately-serviced areas that fall outside of an area considered a threat to municipal drinking water system. One informant noted,

They put the money out in the wellhead or that wiggly line that runs around a source protected area, but what about the areas that are not? Again, lack of funding to do that. So, I guess I would say there wasn't enough funding when they say source protection, to protect it all (SPC Participant).

Furthermore, due to rural Ontario's massive geography, the cost for SWP for rural privately-serviced areas is a factor and a potential barrier for further action at the provincial level.

4.3.3. Social

Table 4.5. Key Findings for Social Capacity

Indicators of Presence	**No. of Interviews Confirming Indicator**	**Percentage of Interviews (n=21)**
There have been provincially funded SWP education and outreach efforts that have raised social capacity in privately-serviced areas.	10	48%
Non-governmental organizations were noted as being important actors in increasing social capacity for SWP in privately-serviced areas.	6	29%
Some lower and upper tier municipal officials were supportive of SWP in privately-serviced areas, which has helped with greater awareness of water issues in the area.	3	14%
Societal norms are changing about water issues, and there is now more awareness about environmental issues in general.	3	14%
Indicators of Absence	**No. of Interviews Confirming Indicator**	**Percentage of Interviews (n=21)**
There is the need to increase education and outreach efforts to those in privately-serviced areas regarding the need for SWP and drinking water related threats.	13	62%
Rural cultural norms, such as resistance to regulations, may be a barrier to SWP in privately-serviced areas.	5	24%

n = The number of total interviews that discussed the element.

Social capacity for SWP in privately-serviced areas encompasses the social influences that impact SWP efforts. Social capacity includes factors such as the social norms (e.g., behaviours, values, attitudes, motivation and commitment) that influence SWP implementation at the household, community and regional level (and beyond). This also includes the ability to create structural networks for SWP through community support, public awareness, stakeholder involvement, and public and private partnerships. Social capacity requires communication and relationships between different interest groups and actors, in order to achieve SWP goals (Minnes, 2017; Rawlyk & Patrick, 2013; Robins, 2008).

In total 21/30 (70% of all participants) spoke to social capacity for SWP for privately-serviced areas in their interview (Table 4.5). Among both the Ontario wide informant (33%) and in the NBMSPA (44%) interview responses, there was not a strong presence of social capacity, and a moderate to high noted absence of social capacity was noted (89% in NBMSPA, 67% in Ontario wide) (Table 4.2). In the CSPA, over half of participants noted both an absence (67%) and presence of social (67%) capacity (Table 4.2). This suggests that there is room for improvement in all instances.

Ten participants (48%) outlined provincially funded SWP education and outreach efforts that have been developed to raise social capacity in privately-serviced areas (Table 4.5). Funding was also available, and has been used, for outreach and education in municipalities (privately-serviced, partially serviced and fully serviced) that were impacted by the CWA. These types of efforts included educational documents available

on provincial and municipal websites about well maintenance and public meetings that included SWP education directed towards those on private drinking water systems. It was explained how the CWA positively impacted social capacity in some privately-serviced areas,

> *We had one challenging situation where a community did not understand why a wellhead protection area should be defined when not all residents were supplied with drinking water from that well. The municipality requested that we host an additional public meeting. It was a chance to go back to the community and say okay, let's hit the pause button. This is what we are doing and why, these are some of the early findings and the key message that the aquifer being protected is the source of water for all the people. So, while they may not drink from the same straw, there are many straws in the same milkshake so to speak* (CA Participant).

Six participants (29%) noted that non-governmental organizations play an important role in raising social capacity in privately-serviced areas (Table 4.5). Examples of non-governmental organizations that were identified include agricultural associations, such as the Ontario Federation of Agriculture and the Ontario Farm Environmental Coalition, as well as local lake associations, community stewardship groups and rural focused organizations such as the Federation of Ontario Cottagers' Association. Furthermore, in January 2018 the Cataraqui Region Conservation Authority along with Quinte Conservation, MOECC and Public Health Ontario ran a public information night on well and septic maintenance. In addition, Cataraqui Region Conservation Authority staff are developing a Groundwater Protection Plan for rural landowners to get a better sense of the risk to groundwater contamination on their property (Furlanetto, 2017).

Three participants (14%) did note that societal norms are changing about water issues,

and there is now more awareness about environmental issues in general (Table 4.5). It was also explained by three participants (14%) that some lower and upper tier municipal officials were supportive of SWP in privately-serviced area, which has helped with creating greater awareness of water issues in general in the area (Table 4.5). For example, one municipal representative said,

> *Yeah and council is pretty open. I mean they will grumble about the cost of some of the stuff but generally they do see the value in it. I mean man we don't have a very big tax base so we fight for everything* (Municipal Participant).

One example of a municipally supported project that has benefitted privately-serviced SWP efforts is the Restore Your Shore program in the NBMSPA. This program was, "developed for the Callander-Wasi subwatershed with the help of a multi-stakeholder Advisory Committee comprised of rural, urban, and agricultural property owners, as well as representatives of local agricultural, community and environmental groups, government ministries and the five municipalities in the watershed" (North Bay-Mattawa Conservation Authority, 2016, para. 6). It was explained by one informant,

> *So, there would have to be some rewards or motivation to keep people engaged and having them involved in these types of projects [as they] move forward. I think with the case of the Restore Your Shore program people all have a good buy in. So, [if] people ran into someone in town they were talking about it. There would be a word of mouth spreading. Yeah you should get involved in this. They would take a picture of the person, it pops up on their website and you can click on who they are and the planting and things like that, and it describes a little about them. And there is a little sign that goes on their property that goes on the waterfront side and that they are a Restore Your Shore program participant and things like that. Trying to generate some sense of social value but also that people should be willing to engage in these things. If you want to protect your waterway you need to do something. Bringing that onus back on the landowner is important* (SPC Participant).

Thirteen participants (62%) expressed a need to increase education and outreach efforts to those in privately-serviced areas about the need for SWP and drinking water related threats (Table 4.5). In regard to the process under the CWA one participant noted the importance of door-to-door visits in privately-serviced areas, as well as diverse forms of education for residents, municipal staff and elected officials. One municipal representative explained that,

> *This is kind of hard to believe but some people do not realize they are on a well. They think it is coming from a source somewhere else and they may not have the knowledge to be like checking it as much as they should be. The concern that I might have is the educational component of that. You know people need to be aware that they are drinking from a well and they need to be getting that tested on the regular basis* (Municipal Participant).

This suggests that, despite existing and past efforts, there is still work to be done to increase knowledge and awareness concerning drinking water issues in privately-serviced areas.

Finally, five participants (24%) explained that rural cultural norms, such as the resistance to regulations, may be a barrier to SWP in privately-serviced areas (Table 4.5). In regard to privately-serviced areas and ways to improve current SWP efforts, one participant explains,

> *... [rural residents] are not typically as open, or you know, in wanting that, because they chose to live in a rural area for a reason. They want the space, they want to be able to make their own decision on their own land and not be impacted by the neighbouring*

properties and all the other pieces, right? And that their best interest is to be the best stewards of their land. Because you know that's where they are living, that's where they are getting all of their water from, right? So, I do think there needs to be a different approach for that. And that is why we are looking at some other approaches that could be applied in a more simplistic way, not simplistic. I want to say simplified way, a new approach (Provincial Participant).

A solution may be to make SWP approaches for privately-serviced areas less prescriptive, and more outreach and education oriented. This would align with the preferences of rural residents as was explained by another participant,

Rural issues, you know there is a political aspect of this. Maybe that hasn't been talked about. Rural residents tend to have a fairly independent-minded approach to rural living. There is both in some respects not a need just generally, there is also not a lot of desire to have any intervention or any overt government involvement or agency involvement in peoples' day-to-day lives, how they run their day-to-day lives or where water comes from frankly (Other Participant).

This sentiment was shared by a provincial representative who stated that rural privately-serviced areas do not want any regulatory form of SWP. Clearly, an approach to SWP in privately-serviced areas is needed that fully takes into account the place specific social factors of the rural communities involved.

4.3.4. Institutional

Table 4.6. Key Findings for Institutional Capacity

Indicators of Presence	**No. of Interviews Confirming Indicator**	**Percentage of Interviews (n=29)**
There is legislation and regulations that protect privately-serviced drinking water supplies.	17	59%

Those privately-serviced areas within a municipal intake/wellhead contributing area under the CWA benefit from the protection of the CWA and associated source protection plans.	7	24%
Indicators of Absence	**No. of Interviews Confirming Indicator**	**Percentage of Interviews (n=29)**
There are inadequate institutional frameworks for SWP for privately-serviced areas in Ontario.	22	76%
During source protection planning under the CWA, source protection committees were encouraged by provincial government staff to not elevate clusters of wells (i.e. privately-serviced areas) into their source protection plan.	10	34%
Legislating SWP for rural, privately-serviced areas has to be done differently than the process for municipal systems under the CWA.	10	34%

n = The number of total interviews that discussed the element.

Institutional capacity for SWP requires proper legislation, regulations, policies, governance, and delegation of responsibility in order to effectively plan and implement SWP (Minnes, 2017; Rawlyk and Patrick, 2013; Robins, 2008). In total 29/30 (97% of all participants) spoke to institutional capacity for SWP in privately-serviced areas in their interviews (Table 4.6). Just over half of participants in both case study regions indicated a presence of institutional capacity (54% in the CSPA, 55% in NBMSPA), and 80% of the Ontario wide participants indicated it was present (Table 4.2). However, amongst both case study regions and the Ontario wide participants, there was also strong sense that institutional capacity is absent (77% in the CSPA, 100% in the NBMSPA, and 100% Ontario wide) (Table 4.2). Again, these results speak to the complexity and diverse aspects of capacity and suggests that even if some institutional frameworks exist to

protect drinking water sources for privately-serviced areas, there are inadequacies with the current institutional framework.

In total 17 participants (59%) said that legislation and regulations exist to protect water supplies in privately-serviced areas (Table 4.6). For example, the Ontario Building Code, the environmental assessment process under the *Environmental Assessment Act*, Wells Regulation 903 under the OWRA and Nutrient Management Plans and Strategies for farm operations phased in under the *Nutrient Management Act, 2002, S.O. 2002, c. 4* (NMA*),* all have positive implications for the protection of drinking water sources in privately-serviced areas. The requirement for Nutrient Management Plans and Strategies under the NMA, and the promotion of voluntary stewardship-based initiatives such as the Environmental Farm Plan, was noted as one of the Ministry of Agriculture, Food and Rural Affair's main contributions to SWP. The *Planning Act*, and the *Municipal Act* and local by-laws were noted tools that municipalities can use in privately-serviced areas for SWP. One Provincial Participant also explained they are "*working with the municipalities bylaws to make sure that wells that are no longer used are decommissioned*" (Provincial Participant). As previously mentioned, there was the example of a municipality in the NBMSPA instituting a septic pumping by-law. However, this program was not enforced. As one Municipal Participant explained,

> *The septic pumping bylaw is that you are required to report to us every 3 years or 5 years depending on the occupancy and prove that you have had your septic system pumped. There are some consequences to that but we are not in a position to go out and inspect septics. [The municipality sends] a letter saying [pump your] septic. If you don't, fine, when you go to sell your house and you want confirmation that everything is fine, [and]*

you haven't had your septic system [maintained]. We've got it on our GIS (Municipal Participant).

As displayed by this quote, both mandatory and voluntary septic inspection programs were seen as beneficial to SWP. One very important service the local public health units provide is the testing of private system water for *Escherichia coli* and total coliform bacteria (Krolik et al., 2013). Their presence indicates likely contamination from sources such as a septic systems or agriculture manure, and that increased SWP efforts may be needed.

Seven participants (24%) said that privately-serviced areas within a municipal intake/wellhead contributing area under the CWA benefit for the protection of the CWA and associated source protection plans (Table 4.6). In the source protection plans there are both legally and non-legally binding policies that have positive implications for privately-serviced areas in the source protection areas. Though the source protection plans were not created to protect drinking water sources in privately-serviced area (they were municipal water system focused), one participant said the protection "*will rub off"* (SPC Participant) to privately-serviced areas. Septic systems in privately-serviced areas within the contributing area of a municipal system were noted as being of great concern. This identified threat resulted in changes to the Building Code, which now requires mandatory inspections of septic systems within a contributing area identified in source protection plans (Government of Ontario, 2017a). It was explained by a Provincial Participant,

S*o, for example for septic systems, when we knew that was going to be a very, one of our*

number one threats across the province, we ended up getting a lot of push from our stakeholders saying we want consistent application across the province. So, we ended up building into the Ontario Building Code a mandatory inspection, re-inspection program. So that ended up being a legislated thing as opposed to local decision making (Provincial Participant).

Despite the institutional tools that do exist for SWP in privately-serviced areas, 22 participants (76%) indicated that the institutional framework for SWP for privately-serviced areas in Ontario, is inadequate (Table 4.6). One participant explains in regard to the need of legislation like the CWA,

There was lots of legal analysis done by us and others about the fact that the existing tools were inefficient. To you know protect drinking water in a binding way and to actually protect people. And that remains true today. So, doing these things as best practices on a voluntary basis, if the municipalities feel like it, if it happens to get to the top of their to-do lists, is just not going to work. It's already taken you know 16 years since the tragedy to get to the municipal, municipalities now implementing the source protection plans under the binding, legislated mechanisms that are in place. And the only reason they've all done it is because they were obliged to do it by the Act and had deadlines under the Act. There is no way that municipalities would have done this to this point for the municipally treated systems in anything like the shape we have. They were just you know working with existing tools. Or even if we had the new tools and it was optional for them to pursue them. So, it's just completely poppycock to think that this is going to work. It's just not going to work. Proof is in the pudding, we are 16 years after the tragedy and this has not been happening (Other Participant).

Though the ability to elevate a cluster of six or more wells or intakes is legally possible (Government of Ontario, 2006, Section 4.1), ten participants (34%) indicated that their area's source protection committees were actively encouraged not to do this by Provincial liaisons (Table 4.6). The main reason given was that as privately-serviced areas were to be included in the next round of planning under the CWA (not the initial). However, there is no evidence that privately-serviced areas will be included in the next round of planning

for the CWA (McClenaghan & Lindgren, 2017). Furthermore, the aforementioned example of the privately-serviced community of Trout Creek (in the municipality of Powassan) being elevated into the NBMSPA, was unsuccessful. Ten participants (34%) said legislating SWP for rural, privately-serviced areas, has to be done differently than the process for the first round of planning for municipal systems under the CWA (Table 4.6). One Provincial Participant explained,

> *So, could we do more to protect those rural areas? Yes. But it is extremely complex because those are individual landowners, those are not communal systems. A lot of what is happening in those areas with your quality of water has to do with the actual activities that those landowners are doing on their own property* (Provincial Participant).

Furthermore, for those rural areas located outside of the boundaries of conservation authorities (e.g., unorganized townships), finding a champion for SWP efforts can be difficult. For example, unorganized townships in Northern Ontario are at a greater disadvantage capacity wise, with nothing but local service boards, which generally do not have water services as one of their responsibilities. Legislating for privately-serviced areas is extremely complex, resulting in challenges to enhancing institutional capacity for SWP in these areas.

4.4. Conclusions

The program under the CWA captures 90% of Ontario's population, which is a commendable start. Arguably, Ontario's municipal drinking water systems are the best protected in the world (Environmental Commissioner of Ontario, 2017). However, the process provided limited protection for the largely rural, privately-serviced, population

that includes millions of Ontarians who rely on private wells for drinking water. This research supports other sources that refer to a major institutional gap in SWP for privately-supplied areas. For example, in 2014, the Canadian Environmental Law Association, sparked an Environmental Bill of Rights review, asking that the MOECC review the regulatory framework governing Ontario's wells. It was argued that the current framework is,

> …incomplete, outdated, and inadequate to protect the environment and public health and safety, and that it is plagued by serious interpretive problems, unacceptable loopholes, substantive shortcomings, and enforcement difficulties related to regulatory deficiencies, inconsistencies between legal requirements and best management practices, and wells on brownfield sites (Environmental Commissioner of Ontario, 2017, p.32).

This research supports these criticisms of the current legal framework for SWP and overall stewardship of privately-serviced areas. Furthermore, findings from a 2008 report prepared for the MOECC on including "other systems" in source protection planning are still relevant in 2017,

> The existing regulatory system provides a good framework for ensuring that drinking water sources in Ontario are protected. The biggest challenges that exist relate to education and awareness of the legal requirements, followed closely by consistent enforcement or implementation. In many cases there is substantial confusion as to roles and responsibilities that result in inaction that can create and maintain threats (Central Lake Ontario Conservation Authority and Jagger Hims Limited, 2008, p. 46)

In addition, the 2016 Ontario Auditor General report pointed to the need to better consider the feasibility of SWP protection plans for private well supplies (Ontario Auditor General, 2016).

One key barrier to action identified in this article is a lack of financial resources. In much of the rural context, privately-serviced residents do not have the same easily identified communal costs of municipal drinking water systems such as municipal pipes, treatment systems, and operators. Most water related costs in privately-serviced areas are borne by the landowner. There was a perception by participants that landowners do not want to be taxed for any type of water service (including SWP efforts). This makes it unpalatable for elected officials to impose any financial obligations on landowners for anything drinking water related. As noted, areas in northern Ontario that are unorganized have even less capacity (financial as well as social, institutional, technical/human) for SWP than municipalities, which is an area of research that requires more attention.

As seen, in the absence of a province wide strategy, some source protection authorities (conservation authorities) have undertaken their own local initiatives to better protect privately-serviced areas (e.g., public information nights and Ground Protection Plans guidebooks spearheaded by conservation authorities). These kinds of actions have the potential to increase both technical and social capacity, especially if done on the regional/local level. There are also examples of toolkits nationally that can provide support to municipalities for private well groundwater protection. For example, British Columbia's Groundwater By Laws Toolkit outlines tools such as zoning bylaws and development permit areas, that can be employed by municipalities to aid in groundwater protection in privately-serviced areas (Jatel, Curran, Geller, Everdene, & Garcia, 2009).

In conclusion, it was found that privately-serviced rural communities often do not see the protection of drinking water as one of their mandated responsibilities, and there are regulatory and policy gaps for SWP in these areas. Further, these municipalities often lack the ability in terms of financial and human/technical capacity to enact SWP efforts without aid from either/or regional level organizations (such as conservation authorities) and the provincial government. This lack of capacity for SWP in privately-serviced rural municipalities is an issue due to the prevalence of neoliberal approaches to water governance in Canada that download water responsibilities to the local level (Cohen, 2012). The use of many of the legislative tools that offer potential for SWP in privately-serviced areas depends on how proactive the municipality is and the presence of various capacities. This research shows that there are legislative gaps as well as technical/human, social and financial capacity gaps for undertaking SWP in privately-serviced areas in Ontario. Investigation is needed into options for a new, integrated, implementable and context appropriate SWP framework for privately-serviced areas in rural Ontario that takes these gaps into account and attempts to tackle them.

4.5. Appendix

Table A4.1. Elements of Capacity for Source Water Protection (Adapted from Minnes, 2017)*

Element	**Definitions and Example Indicators**
Institutional	The legislation, regulations, policies, protocols, governance arrangements and delegation of responsibility to plan and enact SWP. Example indicators include: • Provincial legislation and policies provide guidance for drinking water protection at the local level • Municipal planning strategies and by-laws protect current drinking water supplies

	• Land use activities are controlled in municipal well field, recharge and watershed water supply areas • Land has been purchased for the protection of current municipal water supplies • Plans have been developed to guide municipal actions during water quality emergencies • All responsible for SWP know their responsibilities for implementation and enforcement • Institutional arrangements for land water management is integrated • Local land use planning supports SWP at a watershed or regional level
Financial	The ability to acquire adequate funds to pay for SWP efforts as well as for ongoing planning, governance and management efforts. Example indicators include: • Organizations responsible for protecting source water supplies are able to maintain a balanced budget • Organizations responsible for protecting source water supplies are able to obtain funding from outside sources • Water rates for customers reflect the full cost of protecting and providing municipal drinking water (including treatment, distribution, maintenance, and SWP) • Compensation for farmers providing Environmental Goods and Services (through the provisions of clean groundwater and surface water), for the costs/lost income for enacting source protection plan policies. • Funding is available for municipal SWP projects • Financial mechanisms are used to reduce water use (e.g., water rates charged by municipal water utility are used to reduce water consumption)
Social	The social factors that influence SWP governance and implementation. This includes social norms (e.g., values, attitudes, behaviours, sense of place, trust, reciprocity, commitment and motivation) that impact public awareness, stakeholder involvement, community support, and public and private partnerships in SWP efforts. This also incorporates structural networks, communications and the relationships between different groups interests and actors. Example indicators include: • Clear leadership for water quality protection at the watershed level exists • Active linkages between municipality and provincial agencies exist (vertical linkages)

	• Active linkages among watershed municipalities exist (horizontal linkages) • Active linkages between municipality and community organizations exist (horizontal linkages) • Community awareness and support for watershed protection
Technical/human	The physical and operational ability of an organization to perform SWP management and operations adequately. Also, having the human resources, with adequate knowledge, skills and experience to properly create SWP plans and implement needed measures. Example indicators include: • Organizations responsible for protecting source water supplies have employees dedicated to water management • Organizations responsible for protecting source water supplies have access to individuals with the necessary skills and training to manage drinking water • Education and training opportunities are available to staff members from organizations involved in SWP • Organizations responsible for protecting source water supplies have access to individuals with the expertise needed to undertake technical activities related to drinking water quality • Access to the data needed to manage water supplies, delineate watersheds and aquifers, and develop source protection plans

* Indicators based on**:** (Ivey, de Loë, Kreutzwiser, et al., 2006; Minnes, 2017; Noble & Basnet, 2015; Rawlyk & Patrick, 2013; Robins, 2008; Timmer et al., 2007)

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5. Watershed Governance or Intake Governance? Implications of Ontario's *Clean Water Act* on Collaborative Watershed Governance in Rural Areas

By: Sarah Minnes

Abstract

This research examines the extent to which the *Clean Water Act (S.O. 2006, c. 22)* (CWA) in Ontario, Canada is an example of collaborative watershed governance, with a focus on rural communities. This research also provides lessons for source water governance in Ontario and elsewhere, while also contributing to the evolving collaborative governance theory development from the perspective of water governance. A case study approach was employed that incorporated in depth exploration of 30 key informants' experiences within the Cataraqui Source Protection Area and the North Bay-Mattawa Source Protection Area. The findings of this study suggest that source protection planning process under the CWA improved communication, collaboration, transparency, integration, knowledge sharing, and trust amongst watershed actors. However, there are still improvements to be made to make this process a model example of collaborative watershed governance. Communities and individuals within watersheds contributing to source water supplies need to better understand their role in source protection efforts. Factors such as the inflexibility to accommodate local concerns in the legislated planning process, uncertainty regarding funding for implementation efforts in the future, and an absence of public interest, have all negatively impacted the effectiveness of the collaborative governance of source water supplies in rural Ontario. Furthermore, there was a lack of community-level ownership of the source protection plans within the source

protection areas that were not impacted by binding policies. There is a need for the source protection process under the CWA to better involve the entire watershed in future source water protection planning efforts.

Keywords: source water protection; rural; watershed management; collaborative watershed governance; Ontario

5.1. Introduction

In 2000, the contamination of Walkerton, Ontario's water supply by *Escherichia coli* O157:H7 and *Campylobacter jejuni* killed seven people and resulted in 2300 cases of serious illness (de Loë, Murray, Michaels, & Plummer, 2016; Livernois, 2002). The inquiry report, following the Walkerton tragedy (The Walkerton Inquiry led by Justice O'Connor), found that a lack of source water protection (SWP) was a contributor to the contamination of Walkerton, Ontario's municipal drinking water supply (O'Connor, 2002a). One of the key recommendations in Part 2 of the Walkerton Inquiry report was the creation of watershed-based source protection plans (O'Connor, 2002b). This recommendation has led to stricter SWP legislation and new governance structures for source water supplies in Ontario through the *Clean Water Act (S.O. 2006, c. 22)* (CWA) (Murray & de Loë, 2012). SWP under the CWA in Ontario was designed to be an integrated, science-based approach, using multiple public and private actors to create source protection plans on a watershed basis (Ontario Ministry of Environment, 2006a). This paper will explore through a collaborative governance framework (see Table A5.1) to what extent has the CWA been an example of collaborative watershed governance and

the ways in which the CWA has impacted collaborative watershed governance in Ontario. Implications of these findings for rural areas in Ontario and beyond are explored, while also contributing to collaborative governance theory development from the perspective of water systems and watershed governance.

5.1.1. Collaborative Watershed Governance

In response to a failure of traditional government to address public problems and goals, a "new governance" paradigm emerged in the 1990s that relied on multi-actor structures to address societal goals (Vodden, 2015). In comparison to government, governance used in this way is more bottom-up and horizontal in structure. Governance can occur at the international, national, provincial and/or local level and is conceptualized today as a shared, collective effort of various actors including: government, private business, civic organisations, municipal/local elected officials and staff, political parties, universities, and members of the general public. Decision making through governance is more bottom-up and horizontal in structure than top-down and vertical, as is typical of government decision making (Jentoft & Chuenpagdee, 2009). Governance can be seen as a continuum of systems of governing where state and non-state actors play a variety of roles (Bulkeley, 2005; Stoker, 1998).

Collaborative governance brings together public and private stakeholders in collective forums to engage in consensus-oriented decision making (Ansell & Gash, 2008). Polycentric structures required for collaborative governance have been found to enhance innovation, learning, adaptation, trustworthiness, and cooperation among participants, and

can achieve more effective, equitable, and sustainable outcomes at multiple scales (Claudia Pahl-Wostl et al., 2013). In addition, collaborative governance can result in making innovative and flexible policies that can survive political barriers (Biddle, 2017; Weber, 2012). Bidwell and Ryan (2006) outline a growing preference for these types of governance strategies in relation to watersheds, particularly for collaborative watershed partnerships that are decentralized, participatory, and involve consensus-based problem-solving, yet are working in conjunction with traditional bureaucratic institutions. Authors such as Vodden (2015) and Reed & Bruyneel (2010) suggest that solutions for water problems must involve interaction between both governmental and non-governmental actors, and that collaboration between these actors enhances the effectiveness of water policies and plans. Furthermore, collaborative watershed governance arrangements are observed to improve the ability to resolve collective action problems and are expected to lead to better outcomes than more top-down traditional approaches (Biddle, 2017).

Although governance arrangements are often considered important for promoting environmental protection, factors such as uncertainty, complexity, fragmentation, diversity, interdependence, conflict, lack of incentives to cooperate, knowledge gaps, distrust, and inclusion issues can prove to be challenges (Booher & Innes, 2010; Memon & Weber, 2010). Factors such as difficulties in resolving trade-offs, capacity of actors, and property rights issues can constrain collaborative initiatives for water planning (Ananda & Proctor, 2013). Collaborative governance also takes time, especially when working towards consensus building (Ansell & Gash, 2008). Collaborative watershed governance was chosen to be used as a framework in this research because the

governance process under the CWA engages multiple actors in the decision-making process and relies on public consultation at the local level during the planning process (Ontario Ministry of the Environment and Climate Change, 2017). Collaborative governance typically includes multi-level governance interactions and may therefore be referred to as multi-level collaborative governance (Gibson, 2018).

Best practices and constraints should all be taken into consideration when developing collaborative watershed governance arrangements. Rigorous monitoring and evaluation helps to ensure collaborative governance approaches are producing positive outcomes, and aids in providing avenues for adjustments where needed (Emerson et al., 2012; Vodden, 2015). Such monitoring and evaluations include ensuring all key elements of collaborative governance are in place. Through extensive literature review, key elements of collaborative watershed governance were defined at the outset of this research. All elements explored in this research are outlined in Table 5.1 and definitions of the elements are provided in Table A5.1 (see also Chapter 2).

Table 5.1. Elements of Collaborative Watershed Governance

Elements
Legislated process/organized structure
Integration
Right actors at the table
Shared ownership and accountability
Knowledge sharing and learning
Public participation
Trust building and transparency
Fairness
Adequate resources and capacity

Common benefit evident
Evaluation, adaptability, and flexibility

5.1.2. Watershed Governance and Source Water Protection in Ontario

Nineteen source protection areas and regions were created under the CWA. Most of them are in southern Ontario as they are mainly based on conservation authority boundaries (which are largely only in existent in southern Ontario). Three of them are source protection areas (representing the boundary of one single conservation authority), and sixteen are source protection regions (created by amalgamating groupings of two or more conservation authority boundaries) (Minnes, 2017). In Ontario, conservation authorities are governed under the *Conservation Authorities Act, R.S.O. 1990, c.27*, and serve as local water management organizations. Conservation authority jurisdictions have been created based on watershed boundaries (de Loë et al., 2016; Plummer, Velaniskis, de Grosbois, Kreutzwiser, & de Loe, 2010). Each source protection region/area has a multi-stakeholder source protection committee that collaboratively designed regional source protection plans (Baird, Plummer, Morris, Mitchell, & Rathwell, 2014; Plummer et al., 2010). Conservation authorities act as the source protection authority (a lead authority is designated in the case of source protection regions made up of several conservation authorities), and are tasked with coordinating the process, providing technical support, and overseeing the assessment report, planning process, and ongoing implementation, monitoring, reporting and updating of the source protection plans (Mitchell et al., 2014). The source protection authority appoints source protection committee members, and the Minister of Environment and Climate Change appoints the chair. Source protection

committees are composed of 10–22 members (1/3 commercial, agriculture or industry; 1/3 municipal sector; and 1/3 from academic, professional, non-government organization sectors or the general public). In addition, if there are First Nation communities located within the source protection area/region, committees of 10, 16 or 22 members had to include 1, 2 or 3 First Nation representatives, respectively. The committees also contained non-voting liaisons from local public health units and Ministry of the Environment and Climate Change (Ontario Ministry of Environment, 2006b).

The implementation of all 22 source protection plans (created by 19 source protection committees) is currently underway (Government of Ontario, 2015). Municipalities are responsible to ensure mandatory policies under the source protection plans are implemented, with the help of risk management officials (either a municipal staff member or the role can be delegated to conservation authority staff). Municipalities are expected to use planning tools such as by-laws and amendments to Official Plan policies to implement mandatory policies under the source protection plans (Plummer et al., 2010; Minnes, 2017). The Government of Ontario states, "The Clean Water Act ensures communities protect their drinking water supplies through prevention – by developing collaborative, watershed-based source protection plans that are locally driven and based on science" (Government of Ontario, 2015, para. 11). This paper will explore to what extent and the ways in which the planning and implementation process under the CWA has been an example of collaborative watershed governance, with a particular focus on rural areas, and examine resulting benefits and challenges for SWP in Ontario while also contributing to the evolving collaborative governance theory development from the

perspective of water governance.

5.2.Materials and Methods

A case study approach was employed in this research (Yin, 2011) to allow for in depth exploration of the experience within two rural Ontario regions. The two source protection areas chosen were the Cataraqui Source Protection Area (CSPA) in eastern Ontario and the North Bay-Mattawa Source Protection Area (NBMSPA) in 'near north' Ontario (Figure 5.1). Both case study regions were chosen because of their largely rural composition. For the purposes of this research, the researcher took a very inclusive definition of rural based on the Ontario Ministry of Agriculture and Rural Affairs definition. This definition outlines rural as: all Statistics Canada's census subdivisions (including lower tier and single tier municipalities) that meet at least one of the following criteria, as per the latest Census of Population: have a population of less than 100,000 people; and/or have a population density of 100 people/km2 or less (Ontario Ministry of Agriculture Food and Rural Affairs, 2017).

The research began with an extensive literature review and document analysis, which included academic literature used to refine the collaborative watershed governance conceptual framework (see Table A5.1) and policy/document analysis of Ontario's drinking water legislation, regulations, policies and programs and other related documents such as websites, meeting minutes, etc.

5.2.1. Semi-Structured Key-Informant Interviews

Thirty-one key informant interviews were conducted with various stakeholders in the both case study regions as well as with select key informants having a provincial perspective (see Table 5.2). One key informant decided to withdraw their information from the study, resulting in n= 30. All key informant interviews were conducted in confidentiality as per the informed consent process. The Grenfell Campus (Memorial University) Research Ethics Board found the research to be in ethical compliance with the Canadian Tri-Council Guidelines (reference number 20161916).

Key informants were targeted based on their familiarity with the rural context as well as their role within the source protection planning and implementation process. Interviewees also suggested additional key informants. Semi-structured interviews were conducted using questions to assess each elements of collaborative watershed governance, as outlined in Table A5.1.

Table 5.2. Key Informant Interviews Analyzed (*n* = 30)

Sector	**Identifier in Article**	**Total**	**CSPA**	**NBMSPA**	**Ontario Wide**
Source protection committee member	SPC Participant	9	4	5	0
Provincial staff	Provincial Participant	4	3	1	0
Upper/lower tiered municipal staff and elected officials	Municipal Participant	8	4	4	0
Conservation authority/Conservation Ontario staff	CA Participant	5	2	1	2
Non-governmental expert or consultant	Other Participant	4	0	1	3

Total	30	13	12	5

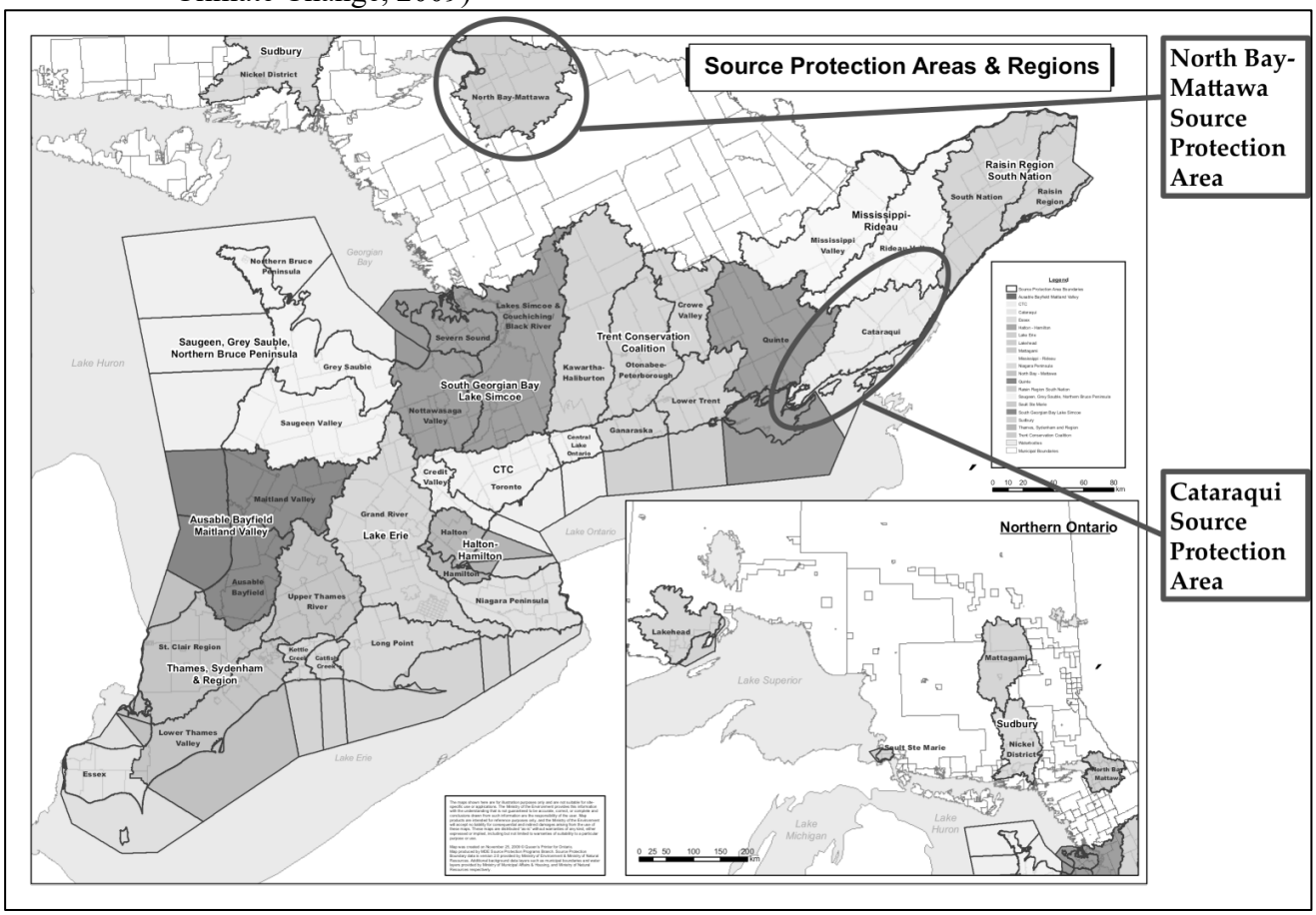
5.2.2. Analysis

Coding of interview transcripts (in one case interview notes) was conducted using NVivo qualitative research software. Key informant responses were coded according to each element of collaborative watershed governance identified in Table A5.1. After general coding was conducted, the researcher went back to each code and recoded the data as either displaying a presence or absence of the element (using the indicators for each element) (Table A5.1). The percentage of interviews in each case study region, and from Ontario wide interviews that discussed the element and confirmed through their answers the presence or absence of the element were calculated following the re-coding. Subsequently, interviews were further coded to determine how many interviewees supported each key finding in their interview at least once. If three or more participants (10% of the sample) noted the same indicator, this was coded as a key finding, and the number of interviews confirming each indicator was tracked. Many key findings pertained to one or more elements of collaborative watershed governance (Table A5.1). All key findings are located in Table 5.4.

Lastly, member checking (i.e. ground truthing) was used to ensure all key findings were valid (Birt et al., 2016). Member checking was done in three ways: 1) follow up meetings with select participants; 2) asking for quote approvals/clarification from some participants; 3) creating a knowledge brief on the key findings of the paper and preliminary recommendations. Each participant was sent the knowledge brief document

by email and given at least one month to respond. The feedback from this process informed the final findings and conclusions of this research.

Figure 5.1**.** Case Study Locations (Ontario Ministry of the Environment and Climate Change, 2009)



5.3. Results

This section outlines the findings from the key informant interviews. The presence and absence of each element analyzed (see Table A5.1) is provided in Table 5.3

Table 5.3. Percentage of the Presence and Absence of Each Element of Collaborative Watershed Governance

Element						
Legislated process/organized structure (x=30)	**CSPA (n=13)**		**NBMSPA (n=12)**		**Ontario Wide (n=5)**	
	+	-	+	-	+	-
	92%	77%	100%	92%	100%	100%
Integration (x=27)	**CSPA (n=11)**		**NBMSPA (n=12)**		**Ontario Wide (n=4)**	
	+	-	+	-	+	-
	82%	64%	83%	58%	75%	50%
Right actors at the table (x=20)	**CSPA (n=8)**		**NBMSPA (n=10)**		**Ontario Wide (n=2)**	
	+	-	+	-	+	-
	100%	63%	100%	50%	50%	50%
Shared ownership and accountability (x=28)	**CSPA (n=12)**		**NBMSPA (n=11)**		**Ontario Wide (n=5)**	
	+	-	+	-	+	-
	92%	83%	100%	91%	100%	100%
Knowledge sharing and learning (x=28)	**CSPA (n=12)**		**NBMSPA (n=11)**		**Ontario Wide (n=5)**	
	+	-	+	-	+	-
	92%	83%	100%	73%	80%	100%
Public participation (x=21)	**CSPA (n=9)**		**NBMSPA (n=11)**		**Ontario Wide (n=1)**	
	+	-	+	-	+	-
	100%	78%	73%	100%	100%	100%
Trust building and transparency (x=28)	**CSPA (n=12)**		**NBMSPA (n=12)**		**Ontario Wide (n=4)**	
	+	-	+	-	+	-
	100%	58%	92%	50%	100%	0%
Fairness (x=28)	**CSPA (n=11)**		**NBMSPA (n=12)**		**Ontario Wide (n=5)**	
	+	-	+	-	+	-
	55%	91%	58%	92%	20%	100%
Adequate resources and capacity (x=30)	**CSPA (n=13)**		**NBMSPA (n=12)**		**Ontario Wide (n=5)**	
	+	-	+	-	+	-
	100%	69%	100%	92%	100%	80%
Common benefit evident (x=29)	**CSPA (n=12)**		**NBMSPA (n=12)**		**Ontario Wide (n=5)**	
	+	-	+	-	+	-
	92%	83%	92%	67%	60%	100%
Evaluation, adaptability, and flexibility (x=29)	**CSPA (n=12)**		**NBMSPA (n=12)**		**Ontario Wide (n=5)**	
	+	-	+	-	+	-
	100%	83%	100%	83%	100%	100%

x = Total number of participants that discussed element

n = Number of interviews that discussed the element in each region
+ = Percentage of participants in the region that indicated a presence of the element
- = Percentage of participants in the region that indicated an absence of the element

Table 5.4. Key Findings Pertaining to the CWA and Collaborative Watershed Governance

Indicators of Presence	**No. of Interviews Confirming Indicator**	**Percentage of Total Interviews (n=30)**
Legislated and organized governance structure with clear formalized responsibilities and rules that facilitated trust, transparency, integration, and knowledge sharing	30	100%
Planning process increased communication at the watershed level about water quality issues in general	28	93%
Planning process designed to foster knowledge sharing and learning amongst watershed stakeholders	26	87%
Science based policies aided in watershed stakeholders' buy in of source protection plans and related policies	24	80%
CWA and related decision-making processes integrated other related legislation to fill in identified policy gaps	22	73%
Increased capacity at the conservation authority level provided important local, context specific guidance to decision makers and implementers	22	73%
Source protection committees were the right mix of actors for collaborative watershed governance; aided in the balancing of social, economic, and environmental considerations within plans and engaged diverse stakeholders	19	63%
Consensus-oriented decision-making process at the committee table allowed for healthy debate and productive conflict	13	43%
High data sharing amongst government and non-governmental organizations during the assessment and planning stages	9	30%
Indicators of Absence	**No. of Interviews Confirming Indicator**	**Percentage of Total Interviews (n=30)**
Assessment work, planning process and final source protection plans were too focused on protecting public water systems' wellhead protection areas/intake protection zones	25	83%
Much of the technical information presented at public events was not fully understood by the intended audience.	23	77%
Inflexibility for local concerns impacted feelings of ownership and common benefit	22	73%

Public engagement was limited, and better engagement techniques (including incentives) are needed	19	63%
Unknown and diminished implementation funding, impacts the overall commitment and quality of implementation, evaluation, and adaptation of source protection plans into the future	16	53%
CWA was not designed for the protection of source water supplies contributing to privately-serviced rural areas	14	47%
Missions, objectives, and scope of the planning process under the CWA did not always stay constant	14	47%
Privately-serviced municipalities within the source protection areas lacked ownership and feelings of common benefit related to the planning process and the policies under the source protection plans	12	40%
Lack of representation of First Nation communities and limited feelings of ownership of the source protection plans by First Nation communities within the source protection areas	10	33%

5.3.1. Legislated Process/Organized Structure

Thirty participants (100%) spoke to the legislated process/organized structure element (Table 5.3). In both source protection areas and amongst the Ontario wide participants, it was indicated there was both a strong presence (92% CSPA, 100% NBMSPA, 100% Ontario Wide) and strong absence (77% CSPA, 92% NBMSPA, 100% Ontario Wide) of this element (Table 5.3). This suggests legislation/organization exists and was deemed as beneficial for watershed collaborations in the source protection areas, however, there are issues with the CWA. For example, the legislated process under the CWA was noted by 30 participants (100%) as beneficial for achieving improved watershed collaboration in the source protection areas. The CWA and its regulations provided clear formalized responsibilities and rules related to governance, data collection, and implementation. This clarity enhanced trust, transparency, integration, and knowledge sharing amongst

watershed actors. The highly legislated process produced high-quality source protection plans and associated scoping documents such as the terms of reference and the assessment reports. The legislation also created a clear framework for data collection.

The highly legislated process under the CWA continues to be beneficial in providing the necessary "teeth" for implementation (which will be discussed further in Section 5.3.4). However, some drawbacks with the legislated process were noted. For example, 14 participants (47%) said the missions, objectives, and scope of the planning process under the CWA did not always stay constant (Table 5.4). Furthermore, 25 participants (83%) said the assessment work, planning process, and final source protection plans were focused on protecting public water systems' wellhead protection areas/intake protection zones, rather than utilizing a watershed approach (Table 5.4). One participant noted that, *"…the idea was that we are moving towards more of an ecosystem- based approach and in the end that is not what happened*" (SPC Participant). Though the legislation process was beneficial, improvements are needed to adequately include the entire watershed in the process.

5.3.2. Integration

Twenty-seven participants (90%) spoke to the concept of integration in their interview (Table 5.3). Generally, amongst all source protection areas and Ontario wide participants (82% CSPA, 83% NBMSPA, 75% Ontario Wide) there was agreement that there was a high level of integration during the planning and implementation process of source protection plans under the CWA (Table 5.3). For example, 22 participants (73%) said the

CWA and related decision-making processes integrated other related legislation to fill in identified policy gaps (Table 5.4). There was also a great deal of coordination among different levels of government and organizations, such as provincial and municipal staff and conservation authority staff, which was stipulated to a certain extent within the CWA legalisation. Furthermore, 19 participants (63%) indicated that the source protection committees were the right mix of actors needed for collaborative watershed governance and aided in the balancing of social, economic, and environmental considerations within the source protection plans (Table 5.4). The diverse source protection committees also engaged diverse stakeholders in the decision-making process.

There was also moderate indication amongst the participants, however, that there is absence of integration (64% CSPA, 58% NBMSPA, 50% Ontario Wide). Those that indicated an absence of integration mainly were concerned with a disconnection between federally regulated areas and tools under the CWA. One Provincial Participant explained that,

Early on in the program because federal lands. Like even take the First Nations piece out of it, any federal lands that are located within a watershed that we are looking at essentially, you know what is our jurisdiction on those? So, we did have a constitutional law review of that. And we did get a decision back. So, we can actively engage in conversation with them. We can share information with them, they can share information with us. But the threats or the potential risks on their properties. We cannot, our plan cannot have an effect on them. So, we can't regulate them. So, their airports, glycol management, their fuel storage, their septic systems. So, all we can do is share that information with. We also, the committees, could write policy, and they did write policies to Transport Canada, to Environment Canada, to other federal agencies around some of the risks. But the legal effect is non-binding on them. It is essentially a recommendation (Provincial Participant).

Furthermore, two participants in the CSPA noted that data sharing was beneficial during the planning stages, but there is a need for strategic and formalized data sharing programs into the future. One participant from the NBMSPA explained that data sharing ventures between non-governmental organizations, academics, and governments has been proven to be advantageous for all parties and should be common practice. This type of integration of data collection efforts was noted as uncommon in both source protection areas.

5.3.3. Right Actors at the Table

Twenty participants (67%) spoke to the adequacy of the actors at the decision-making table during the source protection planning process (Table 5.3) and, as mentioned above, 19 participants (63%) said the source protection committee was the right mix of actors (Table 5.4). Source protection committees are made up of diverse stakeholders appointed by the source protection authorities, with the exception of the chair which was appointed by the Minister of the Environment and Climate Change (Ontario Ministry of Environment, 2006a). All of the participants that spoke to this element in the CSPA (100%) and NBMSPA (100%) agreed that there were indicators of a presence of the right actors at the decision-making table, with some participants also indicating an absence (63% CSPA, 50% NBMSPA) (Table 5.3). Ontario wide participants were less conclusive with half indicating both indicators of a presence (50%) and an absence (50%) of the element (Table 5.3).

The main criticism of the source protection committees was the lack of First Nation

involvement, with 10 participants (33%) saying this was a drawback of the process under the CWA (Table 5.4). First Nation representatives were asked to join the source protection committees if there was a First Nation community within the source protection area boundaries. First Nation communities under the CWA had the option to elevate their public water systems into the source protection plans if they fell within a boundary of a source protection area/region. However, as these systems are federally regulated, this was not mandatory. There were no First Nation communities located in the CSPA. Nipissing First Nation is located within the NBMSPA boundaries, however Nipissing First Nation decided to not be part of NBMSPA's source protection committee. It was speculated that a representative from Nipissing First Nation did not participate in source protection committee meetings due to the travel distance between the band office in Garden Village and the source protection meetings in North Bay during the evenings. It was further explained,

> *I think the conservation authority could be a bit more creative in the way that they approached working with First Nations…Maybe making opportunities available for people to skype into meetings or phone call into meetings or to limit the time commitment that it would take to attend the meetings* (SPC Participant).

Greater attention into how to meaningfully engage First Nation communities in the source protection planning process is required.

5.3.4. Shared Ownership and Accountability

Twenty-eight participants (93%) spoke to the element of shared ownership and accountability. As seen in Table 5.3, there was again mixed results regarding the presence

of this element. While all participants said there was a strong presence of this throughout the process under the CWA (92% CSPA, 100% NBMSPA, 100% Ontario Wide), there was also a strong absence of this element indicated by participants (83% CSPA, 91% NBMSPA, 100% Ontario Wide). Participants felt the CWA clearly lays out responsibilities for the implementation of source protection plans. Responsibility is mainly enacted at the municipal level through risk management officials who ensure that mandatory policies under the source protection plans (i.e., those addressing significant threats) are implemented using planning tools such as by-laws and Official Plan policies. The CWA also legislates monitoring programs and annual progress reports (Ontario Ministry of Environment, 2006b). Twenty-four participants (80%) said science-based policies aided in watershed stakeholders' buy in of source protection plans and related policies (Table 5.4). On participant explained,

> *I think the reason why it will be implemented [source protection plan policies] is twofold. They [municipalities] had a direct hand in the policy formulation, and they felt that their voice was heard* (SPC Participant).

On the other hand, there were indications of an absence of shared ownership and accountability with the CWA. For example, 16 participants (53%) said unknown and diminished implementation funding will impact the overall commitment and quality of implementation, evaluation, and adaptation of plans into the future (Table 5.4). This reflects a lack of ownership and accountability of the provincial government in the long-term. Furthermore, 22 participants (73%) indicated that an inflexibility to accommodate local concerns (e.g. including binding policies for catchment areas for privately-serviced

areas into plans) impacted feelings of ownership and common benefit towards the plan amongst the source protection committee members and other stakeholders within the source protection areas (Table 5.4). One Provincial Participant suggested that the non-legally binding policies (i.e. voluntary) in source protection plans could speak to locally relevant concerns not captured as a significant threat (as defined by the CWA). There was also indication there needs to be increased efforts and incentives to properly engage all watershed residents, not just stakeholders impacted by the binding policies, in the formation and implementation of the source protection plans.

5.3.5. Knowledge Sharing and Learning

Twenty-eight participants (93%) spoke to the element of knowledge sharing and learning in their interview (Table 5.3). Interview participants from both case study regions indicated a high presence of knowledge sharing and learning (92% CSPA, 100% NBMSPA) as well as the Ontario wide participants (80%) (Table 5.3). However, all three types of informants also indicated issues with knowledge sharing and learning (83% CSPA, 73% NBMSPA,100% Ontario Wide) (Table 5.3). As far as those indicating a presence, 26 participants (87%) said the planning process under the CWA was designed to foster knowledge sharing and learning amongst watershed stakeholders (Table 5.4). Furthermore, 28 participants (93%) said the planning process under the CWA increased communication at the watershed level about water issues in general (Table 5.4).

The learning curve during the planning process was noted as difficult at times. For example, as one Provincial Participant explained in regard to elected municipal officials'

understanding of the technical reports associated with the planning process,

> *It was the science piece that was a little difficult for them. So, we had municipal councillors at each one of our tables. I think there was a bit of a weakness there in their ability to translate that information back to council as a whole and explain to them the work* (Provincial Participant).

There were also some issues discussed related to the general public's ability to understand the information (which will be outlined in Section 5.3.6). Even for the source protection committee and conservation authority staff there were challenges with the material. One participant explained,

> *We were being very methodical, we had lots of time in the first year or so to do a lot of basic training and all the sudden, boom boom boom, even technical staff were challenged with the amount of information we needed to consider* (CA Participant).

Clearly, there was a lot of information to be learned. However, this learning process will continue to be ongoing, as long as funding for the program continues (which will be discussed more in Section 5.3.9). The fact that there were learning processes in place to fill identified knowledge gaps amongst decision makers and the general public suggests an overall presence of knowledge sharing and learning under the CWA.

5.3.6. Public Participation

Twenty-one participants (70%) spoke to the element of public participation, with many informants describing both a presence (100% CSPA, 73% NBMSPA, 100% Ontario Wide) and an absence (78% CSPA, 100% NBMSPA, 100% Ontario Wide) of the element

(Table 5.3). Public consultation was required as part of the planning process under the CWA. One participant explained, "*Getting out and talking to people was the most important aspect of the entire SWP effort*" (CA Participant). However, 23 participants (77%) said much of the technical information presented at public events was not fully understood by the intended audience (Table 5.4). This speaks to the difficulty of translating this complicated information. One Provincial Participant explained,

> *Some CAs* [conservation authorities] *were really successful in using social media, and local universities and colleges to help generate buzz, create videos, kind of get the word out. Whereas others were a little bit more traditional. So maybe weren't as successful. And it just really did depend on how, you know on the local conservation authority and how they wanted to approach it. So, maybe that is an area that we could have improved upon* (Provincial Participant).

Nineteen participants (63%) said better engagement techniques are needed to involve participants, including incentives for all watershed stakeholders to become active in the planning and implementation process of source protection plans (Table 5.4). Evidently, there is room for improvement in eliciting public participation in the source protection planning and implementation process through the CWA.

5.3.7. Trust Building and Transparency

Twenty-eight participants (93%) participants spoke to the element of trust building and transparency with very high indication from all regions of its presence (100% CSPA, 92% NBMSPA, 100%) while roughly half of participants indicating its absence in the case study regions (58% CSPA, 50% NBMSPA) and there was no indication of its absence amongst Ontario wide participants (0%) (Table 5.3). The highly legislated process

generated trust that plans would be implemented, as well as a high level of transparency in both the planning and implementation process (as described in Section 5.3.1). Nine participants (30%) noted data sharing among provincial, regional and municipal government departments and local non-governmental organizations was high during the assessment and planning stages of the source protection plans under the CWA (Table 5.4). This suggests different watershed actors were willing to work together during the planning process.

One participant explains the important role the conservation authorities played in inciting trust in the process,

Some municipalities prefer not to have the province enact legislation on water resources, they prefer it being a local matter. But I think they recognized that a) we have brought some provincial money to the table, and b) we have made it as palatable as possible. So, we have almost been like a broker between the municipalities and the province. We are kind of like a broker, facilitator, negotiator (CA Participant).

One concern related to trust in the process, was fear of a potential waning interest in SWP after this initial planning phase was over. One participant explains,

I think so as a human being, I trusted my neighbours that they are going to do the right thing but again I think it is probably new enough that I am also quite certain there are going to be slippages. It's new and exciting and it's a bright star and everyone is thinking about it or concerned about it at this stage. But as time evolves, I think there may be some, a lack of commitment maybe or renewed commitment. I fear that is possible, not a major fear, but I suspect that it may happen (Municipal Participant).

Furthermore, as noted in Section 5.3.1. 14 participants (47%) said the missions,

objectives, and scope of the planning process under the CWA did not always stay constant (Table 5.4). For example, it was not clear at the beginning of the process that privately-serviced areas were not going to be included in the planning process under the CWA. However, overall, trust building and transparency in the process, as well as amongst watershed actors in the source protection areas, were considered positive outcomes resulting from the process under the CWA.

5.3.8. Fairness

Twenty-eight participants (93%) spoke to the element of fairness with a relatively low number of informants indicating a presence (55% CSPA, 58% NBMSPA, 20% Ontario Wide) (Table 5.3). Instead, most informants indicated an absence of fairness (91% CSPA, 92% NBMSPA, 100% Ontario Wide) (Table 5.3). As this research focused on rural, most absence findings related to fairness pertains to inclusion of all rural communities in the source protection areas. This would include communities with municipally operated drinking water systems (i.e. serviced) and those communities that are privately-serviced (e.g. solely or partially served by private wells or other private systems). Fourteen participants (47%) noted the planning process under the CWA as not being designed for privately-serviced rural areas (Table 5.4). One participant explained, that there was not a lot of participation by rural residents, as most in the watershed/source protection area who were in rural areas, are in privately-serviced areas. It was explained, "*We could probably do more on say rural septic systems and drinking water wells. However, our primary focus has been on municipal residential systems that serve the cities and towns*" (CA Participant). Furthermore, the only binding mechanism for protection of private systems

under the CWA, was elevating clusters of private wells into the source protection plan. This was discouraged by provincial staff and seen as an unfair process by one privately-serviced community that was elevated into their local source protection plan (Minnes, 2017). One participant explained,

> *I would think that by its very construct, the CWA excluded rural water. I would say that it's not fair to suggest that, whether it is adequate or not, because it never considered rural water issues. I don't think, except and exclusively where there were very direct connections between a municipal water intake and the water source. Now if their groundwater or surface water was not adjacent to or approximate to municipal water sources it was just excluded period. So, I would say that there were really no considerations for rural water sources in the SWP process in Ontario* (Other Participant).

Nevertheless, there was indication of fairness during the actual decision-making process within the source protection committee. Thirteen participants (43%) said the consensus-oriented decision-making process at the source protection committee table allowed for healthy debate and room for productive conflict (Table 5.4). One participant explains,

> *The chair was able to bring out quiet voices and quiet loud voices. To get that nice balance so everyone had a fair shot at sharing their perspective. Decision making by consensus is the preferred option. I cannot recall a case where the Committee held a formal vote. The SPC worked out its differences around the table* (CA Participant).

Evidence suggests the planning and decision-making process under the CWA, in particular within the source protection committees was fair. However, the process overall was not inclusive of the entire watershed. This resulted in a perceived unfairness of the process by rural residents and advocates.

5.3.9. Adequate Resources and Capacity

All participants (100%) spoke to the element of adequate resources and capacity, and all informants indicated a high presence of this element (100% CSPA, 100% NBMSPA, 100% Ontario Wide) (Table 5.3). Participants in the NBMSPA (92%) area also indicated a high absence, with the Ontario Wide (80%) and CSPA (69%) indicating a relatively high absence of adequate resources and capacity as well (Table 5.3). As outlined above (chapters 3 and 4), the process under the CWA improved capacity for watershed governance, providing financial resources for watershed planning through SWP planning, and improving communication and knowledge about SWP (Minnes, 2017). For example, 22 participants (73%) said the increase of capacity at the conservation authority level during the planning process under the CWA has provided important local, context specific guidance to decision makers and implementers at the watershed level (Table 5.4). Furthermore, the process has improved communication on a watershed level, and the mandatory policies created are highly implementable due to the enforcement powers under the CWA (Minnes, 2017).

The concerns raised regarding capacity and resource limitations pertained largely to ongoing funding for implementation and updating of source protection plans. For example, one participant explains,

> *There was probably over investment and diligence in the process of getting source protection plans in place. With a considerable under resourcing of the on the ground actions. And ongoing implementation of the policy enforcement and the regulatory kind of implications for protecting source water in Ontario* (Other Participant).

Even though there has been capacity built for collaborative watershed governance from the process under the CWA, sustainability of the resources allocated to the process is in question (see Section 5.3.11).

5.3.10. Common Benefit Evident

Twenty-nine participants (97%) spoke to the element of common benefit, with both case study regions indicating a high amount (92% CSPA, 92% NBMSPA) and more than half of Ontario Wide (60%) participants indicating a presence (Table 5.3). Similar to other elements, there were also indications of an absence of a common benefit (83% CSPA, 67% NBMSPA, 100% Ontario Wide) (Table 5.3). As mentioned above, 22 participants (73%) said inflexibility to accommodate for local concerns (e.g., new modelling approaches that would capture threats in the Great Lakes more accurately) impacted ownership and common benefits amongst watershed stakeholders (Table 5.4). Most prominently, 12 participants (40%) said privately-serviced municipalities within the source protection areas lacked ownership and feelings of common benefit related to the planning process and the policies under the source protection plans (Table 5.4). Furthermore, as previously discussed, 10 participants (33%) said there was a lack of representation of First Nation communities and limited feelings of ownership of the source protection plans by First Nation communities within the source protection areas (Table 5.4). These communities therefore did not receive any benefits that have been derived from the process.

It was noted by one participant that in the NBMSPA the source protection planning

process under the CWA did spark interest in protecting the wider watershed. It was explained,

> *So, interestingly enough what followed quickly on the heels of SWP was watershed management plan. The background information gathered from that built on a lot of the information for SWP, but the watershed management plan is more far reaching because the conservation authority is the full watershed, we [the municipality] is just a small part of it* (Municipal Participant).

Clearly, in this case there was an understanding that the source protection plans under the CWA were not designed for source protection for all residents relying on the watershed for drinking water, only those who are deriving their water from a municipally operated public drinking water system.

5.3.11. Evaluation, Adaptability, and Flexibility

Twenty-nine participants (97%) spoke to the element of evaluation, adaptability, and flexibility, with indications from all participants of both a very high presence (100% CSPA, 100% NBMSPA, 100% Ontario Wide) and a very high absence (83% CSPA, 83% NBMSPA, 100% Ontario Wide) (Table 3.3). The CWA legislation clearly outlines requirements for monitoring programs and annual reports, which provides a framework for enforcement, evaluation, and review of the policies and science behind the source protection plans made under the CWA (Ontario Ministry of Environment, 2006b). However, 16 participants (53%) said unknown and diminished implementation funding will impact the overall commitment to and quality of implementation, evaluation, and adaptation of plans into the future (Table 5.4). It was explained by one participant,

> *We need to know that there is a sustainable source of funding to allow for source protection implementation to occur. Since this legislation has been driven by the provincial government, I would argue it would be the responsibility of the provincial government to ensure there are sustainable resources in place going forward, if this is in fact a priority of the province. There are restrictions on local capacity whether we are talking about North Bay and Mattawa or Essex County down by Windsor, to get this stuff done using only the internal resources and capacity of the local level. There has got to be a provincial commitment to this. Not just to get the plans done but ongoing implementation. And in the context of climate change, and how we adapt to whatever climate change is going to throw at us, there is going to be more of a need than ever for the ongoing support of the province of Ontario to source protection authorities to help to continue to do this work. As well as to monitor and analyze change over time* (SPC Participant).

A sustainable fiscal structure is needed in order to secure the future of SWP planning, implementation and related monitoring and evaluation activities under the CWA. Furthermore, flexibility in the planning process to incorporate local concerns was noted as an issue by 22 participants (73%) (Table 5.4). This suggests there are improvements needed to allow for adaptation and more place specific considerations in future planning efforts.

5.4. Discussion

The key findings of this research regarding the characterization of Ontario's CWA and related processes as collaborative watershed governance are displayed in Table 5.4. There are mixed reviews of the CWA as a collaborative watershed governance tool and process, particularly in rural areas (see Tables 5.3 and 5.4). However, some great strides have been made towards collaborative watershed governance during the planning process under the CWA, and now with the implementation of the resulting source protection plans. As can

be seen through this research, many of the central elements of collaborative watershed governance (see Table A5.1) have been employed during the planning process under the CWA, including the bringing together of multiple stakeholders (public and private) to make consensus-oriented decisions (Ansell & Gash, 2008). The CWA has provided opportunities for learning and engagement, and for multiple watershed stakeholders to educate each other on their uses of the watershed. This type of co-learning and creation of shared understandings of watershed issues has been found in previous research to be very important for collaborative watershed governance arrangements (de Loë, Murray, & Simpson, 2015).

The process under the CWA has helped to create context appropriate policies, however, as discussed there has been some criticisms of this process in rural areas. One prominent criticism was the changing scope of the planning process, limiting the ability to include binding policies in source protection plans for the protection of groundwater supplies contributing to private wells. The provincial government has also played an important role in leading the collaboration (with appropriate delegation to the source protection authorities). This aligns with current research which states provincial government should play the following roles in watershed collaborations: "initiation of collaboration, provision of institutional and financial support, and approval and implementation of policies and decisions." (Brisbois & de Loë, 2016, p. 202). However, as the CWA continues past the initial planning phase, there is uncertainty if the provincial government will be fulfilling these roles (most prominently providing financial support).

When evaluating to what extent the CWA has been an example of collaborative watershed governance, some gaps were also identified**.** When considering implications for rural communities (many of which are privately-serviced and therefore do not have a municipal drinking water system), a true watershed approach (Cohen & Davidson, 2011; Schneider, 2010) was not employed. For example, Figure 5.2 displays a wellhead protection area in the NBMSPA. As exemplified in Figure 5.2, the focus of the planning exercise under the CWA was to identify and make policies to protect wellhead protection areas and intake protection zones. Figure 5.3 represents the entire North-Bay Mattawa Source Protection Area watershed.

Figure 5.2. Mattawa Wellhead Protection Area and Vulnerability Scores (North Bay-Mattawa Source Protection Committee, 2012, p. 195)

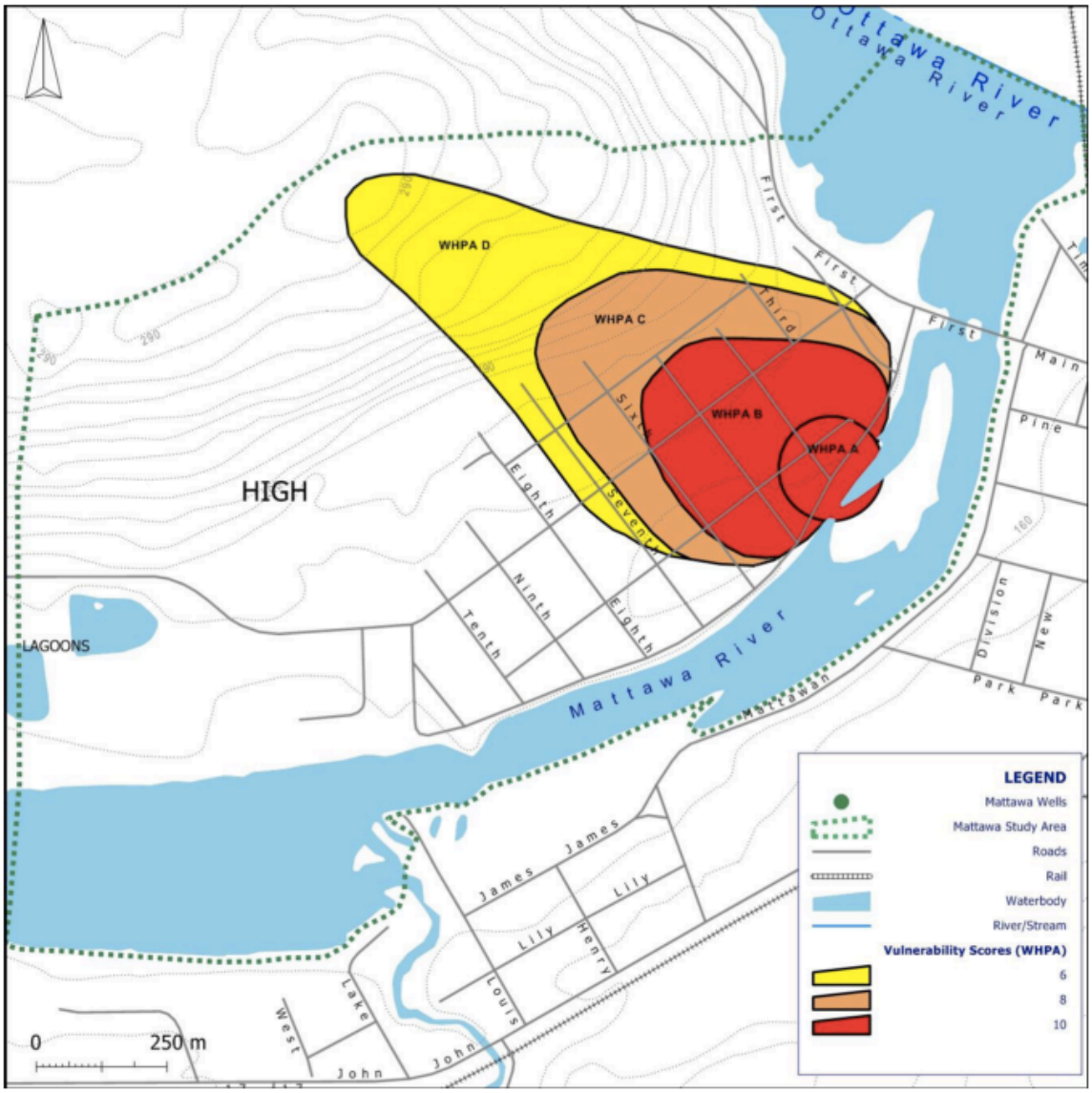


Figure 5.3. North Bay- Mattawa Source Protection Area Subwatersheds (North Bay-Mattawa Source Protection Committee, 2012, p. 13)

As can be seen in Figure 5.2, the identified wellhead protection area is a very small part of the overall watershed contributing to drinking water supplies. However, under the source protection plans, policies can only be defined as "binding" if they pertain to threats considered "significant" within the wellhead protection areas (North Bay-Mattawa Source

Protection Committee, 2012). Significant threats were determined by very inflexible criteria prescribed by the Ministry of Environment and Climate Change (Ontario Ministry of Environment, 2006b). The inflexibility in the highly legislated process under the CWA, made it hard to plan in any meaningfully and enforceable way outside of these wellhead protection areas and intake protection zones of municipal water systems.

Collaborative governance should be flexible, and therefore not be subject to overly rigid top-down rules and structures (Vodden, 2015). Current research warns that provincial governments should be as transparent as possible with what interests are excluded and included during every stage of the policy cycle (Brisbois & de Loë, 2016). It can be seen that due to the narrowing scope of the CWA, this transparency from the outset of the CWA, did not occur. The changing mandate of the scope of the CWA resulted in frustration, particularly for those concerned with protecting drinking water sources in privately-serviced areas. This lack of transparency was seen by participants as unfair (again particularly for rural areas), which is evident in the findings with the absence of fairness being noted by the majority of informants. Furthermore, it is understandable why First Nation and privately-serviced communities did not feel ownership with the source protection plans created under the CWA, as these plans were not created to protect their source water supplies. Furthermore, potentially adding to the lack of ownership by First Nation communities, Simms et al. (2016) explain, there is a difference between collaborative governance and co-governance. It is explained the spectrum goes from, "collaborative processes, in which First Nations play a consultative or advisory role, to co-governance in which First Nations and colonial governments co-create shared forms of

jurisdiction, and First Nations have substantial or legally-binding authority" (Simms, Harris, Joe, & Bakker, 2016, p. 7). It does seem that with the lack of meaningful participation by First Nations in the NBMSPA, that collaborative governance was a goal that was not achieved, with co-governance not even being on the agenda.

As seen in the results of this research, there was a great deal of overlap in the elements and indicators for each element of collaborative watershed governance explored in this research (see Table A5.1). Most indicators were present, but with challenges. These varied opinions on the presence and absence of key collaborative watershed governance elements exemplifies the difficulty in instituting collaborative watershed governance structures in practice. Furthermore, findings suggest that research on SWP policy in practice is very complex, especially considering the multiple perspectives and agendas at play of watershed actors. This makes the investigation of SWP through a collaborative watershed governance framework important in evaluating SWP efforts from multiple perspectives. Implications of the findings above, and how they related to the assessment of collaborative watershed governance, are discussed in the next, final concluding section.

5.5. Conclusion

This research sought to answer the question: to what extent, and in what ways, has the CWA been an example of collaborative watershed governance? Through this research question, lessons relating to collaborative watershed governance in Ontario and elsewhere were discovered. The results of this research also provide contributions to collaborative governance theory development from the perspective of water governance. During this

investigation there was a particular emphasis on implications of the presence (or absence) of collaborative governance in the CWA for rural communities.

The framework used to evaluate collaborative watershed governance (see Table A5.1) proved to be appropriate for this type of research, allowing for the consideration of multiple perspectives on the complexities of SWP in practice. The use of this framework uncovered lessons learned for SWP in rural Ontario and are applicable to other rural jurisdictions in Canada and beyond. This paper worked towards theory building for collaborative watershed governance by providing 11 main elements and numerous indicators for the concept based on the collaborative watershed governance literature (Ananda & Proctor, 2013; Ansell & Gash, 2008; Cave, Plummer, & de Loë, 2013; Connick & Innes, 2001; Emerson, Nabatchi, & Balogh, 2012; Himmelman, 2002; Huck, 2012; Minnes, 2012, 2015; Noble & Basnet, 2015; Rogers & Weber, 2010; Simms & de Loë, 2010; Simms, Lightman, & de Loë, 2010; St-Jacques, 2001; Vodden, 2015; Water Policy and Governance Group, 2011; Weber, 2012). There was a great deal of overlap in the elements and indicators for collaborative watershed governance. In future research, elements could potentially be further refined and consolidated. For example, the element of integration should also be considered in other elements such as right actors at the table and knowledge sharing and learning, and could be merged with the element of legislated process/organized structure.

It was found through this research that the source protection planning process under the CWA improved communication, collaboration, transparency, integration, knowledge

sharing, and trust at the watershed level. However, there are still improvements to be made to make this process a model example of collaborative watershed governance, and thus improve SWP processes and outcomes. As found in previous research, collaborative governance arrangements are often considered important for promoting watershed protection (Biddle, 2017). However, factors such as uncertainty, complexity, fragmentation, lack of incentives to cooperate, knowledge gaps, and inclusion issues can prove to be challenges to collaborative watershed governance (Booher & Innes, 2010; Memon & Weber, 2010). These are all elements that must be considered moving forward with source protection planning and implementation under the CWA.

Communities and individuals who are located within the watersheds contributing to source water supplies need to better see their role in source protection efforts. Factors such as the inflexibility for local concerns in the legislated planning process, unknown future funding for implementation efforts, and a lack of public interest, have all negatively impacted the effectiveness of the collaborative watershed governance of source water supplies in Ontario. In the case study source protection areas used in this research (the CSPA and the NBMSPA), it was found there was a lack of ownership of the source protection plans for those communities within the source protection areas who were not impacted by binding policies. In addition, to increase inclusivity and engagement in the planning process, there is a need for better translation of technical information to the general public in order to achieve true stakeholder engagement, and so citizens can see themselves as valued contributors to the SWP process (Collay, 2010) . Having periodically different locations for source protection committee meetings, may

allow for better engagement of all watershed users in the process. This allows committee members and interested stakeholders located far away from urban centres greater ease in getting to meetings. Also, the option of electronic participation in these meetings could be beneficial, especially during winter months.

The Ontario experience with SWP under the CWA illustrates the challenges (e.g., public engagement, feelings of fairness, etc.) and benefits (e.g., diverse actors at the decision-making table, clear delineation of responsibilities, etc.) of using collaborative watershed governance structures for SWP (Table 5.4). Ultimately, if the Ontario government aims to improve the efficacy of the collaborative watershed governance approach under the CWA, there is a need for the source protection process under the CWA to better involve all stakeholders within the watersheds contributing to source water supplies, in future planning efforts. This would mean an effort towards engaging residents in those areas outside of wellhead protection areas and intake protection zones of municipal public drinking water systems. Furthermore, additional attention should be given to how to achieve greater flexibility within the planning process under the CWA to better allow for consideration of local concerns and approaches related to SWP.

5.6. Appendix

Table A5.1. Elements of Collaborative Watershed Governance*

Element	Example Indicators
Legislated process/organized structure	• Formalized rights, responsibilities, and rules. • Actors/stakeholders feel that having the process legislated was beneficial. • Clear missions, mandates, and/or objectives.

	• Missions and objectives remain constant throughout the planning and implementation process. • High quality agreements/partnership agreements created from the collaboration. • A clear framework for data collection. • New norms created for interaction and business conduct, including communication protocols and the creation of a terms of reference.
Integration	• Coordination among different policy tools at different scales. • Integration with all other necessary actors. • Land and water management policies developed in collaboration. • Consideration of multiple policy goals, that address economic, social and environmental values.
Right actors at the table	• All relevant stakeholders who are needed at the table to make appropriate decisions are represented. • Recognition of the legitimacy of diverse stakeholders and decision-makers. • Incentives for stakeholders to participate. • The acknowledgement that all actors at the table were beneficial to the planning process. • Selection of stakeholders is done in a fair and equitable manner.
Shared ownership and accountability	• All policies are legitimate (genuine approval of institutions or actors subject to policy implementation). • High quality agreements have been made. • Development of commitment to and acknowledgement of responsibility in implementation by all necessary actors. • There is an agency or group of agencies with a leadership role in the assessment and monitoring of implementation. • There is an agency or group of agencies with authority to implement and/or enforce regulations. • Stakeholders hold each other and decision makers accountable for decisions and commitments made. • There is an inter municipal agreement to enact policies. • Watershed residents and organizations champion the plan with ongoing dedication to its successful implementation.
Knowledge sharing and learning	• There is a shared understanding of watershed characteristics. • Creation of a learning environment (e.g., spaces/forums that encourage learning) where there is open flows of communication, dialogue, and mutual learning amongst participants. • Recognition and consideration given to different ways of knowing and interpreting the environment.

	• A sense that the planning process fostered mutual learning between stakeholders and decision makers. • Learning and change beyond decision makers. • Room for innovation and context specific flexibility in process. • Changes in attitudes, behaviours, and actions amongst the greater watershed. • The acknowledgement that participants must engage in a process of self, social, and organizational learning in order to participate effectively in governance. • Different types of learning were effectively facilitated.
Public participation	• Public participation opportunities should incorporate best practices such as: timely engagement; information flows both ways through collaborative dialogue; educational opportunities; transparency of process; equity; empowering policies and incentives; context appropriate engagement methods; engagement of public is inclusive and accessible; issue is linked to socially relevant topics; public representation at the decision making table; opportunities for feedback throughout the process; and ways for the public to be involved in evaluation and monitoring. • Public has the ability to influence decisions. • Financial and technical support for implementation to the public, so that they know and understand their responsibilities and roles in implementation.
Trust building and transparency	• Transparency in the planning, governance, and implementation process. • Feeling of trust and respect to speak freely during planning and decision-making processes. • Understanding of other stakeholders' roles. • Increased communication with watershed stakeholders as a result of the collaboration. • The fostering of public trust in the collaboration and outcomes (e.g., plans, policies, etc). • Local communities are engaged in watershed planning, monitoring, environmental assessment and related decision-making processes. • Agreed-on information and shared understanding of issues. • There is willingness amongst authorities to share data and to coordinate activities related to the watershed plan. • Trust in decision-makers to create appropriate and effective policies. • Trust that all stakeholders will implement necessary responsibilities resulting from the collaboration.

Fairness	• All stakeholders hold equal advantages and power within the decision-making process. • Negotiations and decisions are based on consensus. • Adequate time for the public and municipalities to review plans. • Policies fair for rural and urban areas. • Appropriate ways in place for solving disagreements/conflict. • Balance of power and resources. • An overall inclusive process.
Adequate resources and capacity	• Local communities are engaged in watershed planning, monitoring, environmental assessment and related decision-making processes. • Application of a systematic fiscal strategy to fund the collaboration and outcomes (plans, policy implementation, etc). • Adequate amount of money, expertise, technical information, leadership, external connections, social capital, and institutional power to properly make governing decisions and implement said decisions. • Capacity building is part of the collaboration.
Common benefit evident	• Shared motivations and realization of interdependence in the collaboration. • Decision-makers and other stakeholders believe their involvement is beneficial to their affiliations agenda. • Policies and regulations created seem beneficial and appropriate to implementing bodies. • Belief by stakeholders that the planning process and implementation has been efficient and effective.
Evaluation, adaptability, and flexibility	• Institutions and practices have administrative flexibility for place specific conditions. • Long term goals have been set regarding the health of the watershed. These goals are regularly monitored and re-evaluated. • Mechanisms are in place to consistently monitor change. New information and knowledge is used to improve plans and decisions. • Clear stipulations in the watershed plans of responsibilities for who should be conducting monitoring, evaluation (and which outputs and outcomes should be evaluated), and how data should be stored, communicated, and accessed. • Flexibility for implementation depending on place specific needs.

*Characteristics based on: (Ananda & Proctor, 2013; Ansell & Gash, 2008; Cave,

Plummer, & de Loë, 2013; Connick & Innes, 2001; Emerson, Nabatchi, & Balogh, 2012; Himmelman, 2002; Huck, 2012; Minnes, 2012, 2015; Noble & Basnet, 2015; Rogers & Weber, 2010; Simms & de Loë, 2010; Simms, Lightman, & de Loë, 2010; St-Jacques, 2001; Vodden, 2015; Water Policy and Governance Group, 2011; Weber, 2012)

5.7.References

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6. Summary

6.1. Overview of Objectives and Summary of Results

This concluding chapter summarizes the objectives and results of this research, offers recommendations and directions for future research, and provides overall implications and conclusions of the study. The primary goal of this research was to examine the implementation of Ontario's source water protection (SWP) policies and explore implications for rural regions. The research questions asked were:

1. What have been the successes and challenges with SWP planning and implementation in Ontario?
2. Did the SWP planning process under Ontario's *Clean Water Act, 2006, S.O. 2006, c. 22* (CWA), build capacity for SWP in municipally serviced rural municipalities?
3. Do privately-serviced rural municipalities in Ontario have the capacity for SWP?
4. To what extent has the CWA been an example of collaborative watershed governance?

These questions were explored through 30 semi-structured interviews, in two case study regions. Furthermore, an extensive literature and document review (e.g., academic literature, related reports and resources, and SWP legislation, regulations, and policies) was conducted. Analysis of data was done using Nvivo qualitative data analysis software as well as through member checking, quote approvals/clarifications, and follow up meetings with select key informants. The overall findings of this project are further

explained below and summarized in Table 6.1. These above research questions were explored through several interdisciplinary lenses, as a range of environmental, social, political, and economic systems impact SWP. This interdisciplinary research draws from the disciplines of geography, political science, and environmental science. This research was focused on SWP policy and therefore the frameworks used emphasized the human geography and political science aspects of SWP. However, without the understanding of environmental science theories and concepts (e.g., ecosystems services, hydrogeology and freshwater systems, agriculture, pollution and nutrient loading, eutrophication, etc) it would have been impossible to fully understand the complexities of governing SWP in practice.

Chapter 3 explored research questions 1 and 2 outlined above. Chapter 3 presented findings regarding the successes, challenges, and implications that the CWA had for the building of SWP capacity for rural serviced municipalities (i.e. those municipalities with public drinking water systems). It was found that the process under the CWA improved capacity for SWP in the serviced municipalities who were involved in the planning process and were impacted by the source protection plans. The most prominent challenges with the process under the CWA were a lack of: flexibility for local circumstance when assessing what can be a binding policy in the source protection plans; effective engagement of First Nations; effective engagement of the general public; and sustainable funding for implementation and needed human resources due to diminished provincial government support. It was found that SWP in rural areas requires: commitment at the local level (e.g., decision makers, municipal staff, local health units,

residents, watershed users) to SWP; legislation that allows for place specific implementation while being mandatory and enforceable; sustainable municipal financial frameworks and provincial funding for SWP planning and ongoing implementation; and technical assistance, particularly at the regional level. Conservation authorities were found to be important actors in providing this type of regional level technical aid.

Chapter 4 discussed research questions 1 and 3, focusing on the capacity for SWP in Ontario's privately-serviced rural areas. Findings suggest that rural municipalities (especially those that are completely privately-serviced) often lack the ability to enact SWP efforts without aid from regional level organizations such as conservation authorities and/or the provincial government. The use of many of the legislative tools that can be used for SWP in privately-serviced areas depends on how proactive the municipality is and the presence of various capacities (e.g., institutional, technical/human, social, and financial). There are both legislative gaps as well as technical/human, social, and financial capacity gaps for undertaking SWP in privately-serviced areas. Investigation is needed into options for a new, integrated, implementable, and context appropriate SWP framework for privately-serviced areas in rural Ontario.

Chapter 5 outlined findings related to research questions 1 and 4 regarding implications of Ontario's CWA for collaborative watershed governance in rural areas. The governance structures under the CWA were found to incorporate many of the key elements of collaborative watershed governance. Particularly, through the source protection committees, there was a bringing together of various actors on a watershed basis to

produce source protection plans. The source protection planning process under the CWA improved communication, collaboration, transparency, integration, knowledge sharing, and trust at the watershed level. However, factors such as the inflexibility to accommodate local concerns in the highly legislated planning process, unknown future funding for implementation efforts, and a lack of public interest have all negatively impacted the effectiveness of the collaborative watershed governance of source water supplies in Ontario. In addition, a lack of ownership of the source protection plans by communities within the source protection areas who were not impacted by binding policies under the plans (e.g., privately-serviced communities and First Nation communities) was evident. There is a need for the process under the CWA to better involve the entire watershed (and all watershed actors) in future planning efforts. This would involve expanding the focus of planning efforts beyond the designated wellhead/intake protection zones of public drinking water systems.

In regard to the frameworks used (SWP capacity and collaborative watershed governance), this research provided contributions towards theory building on these two concepts in relation to SWP and water governance in general. The capacity framework used built on the four main categories for SWP capacity provided by Rawlyk and Patrick (2013) with refinements to the indicators based on a review of SWP literature (Ivey, de Loë, Kreutzwiser, & Ferreyra, 2006; Noble & Basnet, 2015; Rawlyk & Patrick, 2013; Robins, 2008; Timmer, de Loë, & Kreutzwiser, 2007). There was a great deal of overlap between the different elements of capacity (e.g. financial capacity issues also impacted human/technical capacity). This demonstrates that the four categories are not completely

independent and intersect. With this acknowledgement of overlapping elements, in the future separating human and technical capacity into their own categories, such as done by Timmer, de Loë, and Kreutzwiser, (2007), may be beneficial. This separation would ensure indicators such as having adequate technical data are not grouped together with specifically human capacity related indicators such as having adequate human resources to implement policies. Further definition of what indicators are specifically related to technical capacity and those that only relate to human capacity could result in greater clarity in findings and in pin pointing exactly where capacity gaps may exist. Despite this suggestion for refinement, the framework for SWP capacity used in this research proved to be useful in evaluating the effectiveness of capacity building efforts and capacity gaps for SWP in rural Ontario.

As noted in Chapter 2, governance theories have been criticized for ambiguity (Bevir, 2011; Jessop, 1995; Jordan, 2008). This research clearly defined what was meant by collaborative watershed governance, providing 11 main elements and numerous indicators based on the collaborative watershed governance literature (Ananda & Proctor, 2013; Ansell & Gash, 2008; Cave, Plummer, & de Loë, 2013; Connick & Innes, 2001; Emerson, Nabatchi, & Balogh, 2012; Himmelman, 2002; Huck, 2012; Minnes, 2012, 2015; Noble & Basnet, 2015; Rogers & Weber, 2010; Simms & de Loë, 2010; Simms, Lightman, & de Loë, 2010; St-Jacques, 2001; Vodden, 2015; Water Policy and Governance Group, 2011; Weber, 2012). Similar to the elements of SWP capacity, there was a great deal of overlap in the elements and indicators for collaborative watershed governance. Upon reflection, the collaborative watershed governance framework used in

this research could potentially be further refined and consolidated (due to the variety of overlapping elements and associated indicators). For example, the element of integration could be merged with the element of legislated process/organized structure, as well as be considered in other elements such as right actors at the table and knowledge sharing and learning. Furthermore, like SWP capacity elements, many indicators were present, but were also noted as being absent or having challenges with being successfully employed. This suggests that SWP policy and its varied impacts on different stakeholders is complex. Using a collaborative watershed governance framework for evaluating SWP efforts proved to be appropriate for uncovering the multiple perspectives on this issue, and for deriving lessons learned for rural Ontario and beyond.

A summary of the overall findings of this research are outlined below in Table 6.1.

Table 6.1. Overall Findings

Chapter **Topic**	**Overall Findings**
Ontario's CWA and capacity building. Implications for serviced rural municipalities	• CWA improved capacity for SWP in serviced municipalities. • Prominent challenges were a lack of: flexibility to accommodate local concerns; effective engagement of First Nations; effective engagement of the general public; and sustainable funding for implementation. • SWP in rural areas requires: commitment at the local level; legislation that allows for place specific implementation while being mandatory and enforceable; sustainable municipal financial frameworks and provincial funding; and technical assistance.
Capacity for SWP in Ontario's privately-	• Rural municipalities, including those that are privately serviced, require technical help enacting SWP. • Implementation of legislative tools that can be used for SWP in privately-serviced areas depend on capacity of municipalities.

serviced rural areas	• There are institutional, technical/human, social, and financial capacity gaps for undertaking SWP in privately-serviced areas. • A new, integrated, implementable, and context appropriate SWP framework for privately-serviced areas in rural Ontario is needed.
Implications of Ontario's CWA for collaborative watershed governance in rural areas	• Governance structures under the CWA display elements of collaborative watershed governance. • CWA improved communication, collaboration, transparency, integration, knowledge sharing, and trust at the watershed level. • Inflexibility for local concerns, unknown future funding for implementation efforts, and a lack of public interest have all negatively impacted the effectiveness of watershed governance under the CWA. • Evident lack of ownership of the source protection plans by communities within source protection areas that were not impacted by binding policies under the plans (e.g., privately-serviced communities and First Nation communities). • Need for the process under the CWA to better involve the entire watershed in future planning efforts.

6.2. Overall Recommendations and Directions for Future Research

6.2.1. Recommendations for Policy and Practice

The overall recommendations of this research in relation to policy and practice research are summarized below:

- Sustainable funding frameworks need to be established for SWP in municipally and privately-serviced rural communities.
    - Realistic fiscal frameworks should be created that involve shared funding arrangements between provincial and municipal bodies to sustain SWP efforts (e.g., further source protection plan and data updates, ongoing monitoring and evaluation, data sharing networks, expert human resources at the municipal and/or conservation authority levels, and public outreach efforts).

    - Regional collaborations could offer value in this matter if municipalities are able to pool resources for actions such as groundwater studies and public outreach.
- Improved methods for public engagement in the SWP process are needed (including greater incentives for involvement).
    - There is a need for better translation of technical information to the general public to achieve true stakeholder engagement, as opposed to consultation.
    - Help from non-governmental organizations in engagement efforts could aid in diversifying engagement techniques and participating audiences.
- Source protection committee meetings should periodically be located in different locations within the source protection areas.
    - Committee members located far away from urban centres are consistently having to travel long distances, which can be a barrier to participation.
    - The option of electronic participation in these meetings could be beneficial, especially during winter months.
- The CWA needs to better involve the entire watershed in future SWP planning efforts.
    - This approach would involve meaningful inclusion of all communities within the source protection areas, especially those who may be located outside of a wellhead protection area and/or intake protection zone and those relying on private drinking water systems.
- A new, integrated, implementable, and context appropriate SWP framework

for privately-serviced rural areas in Ontario is needed. This framework should include:

  - Sustainably funded outreach and education programs for private well owners. These efforts should incorporate creative and effective public engagement strategies and collaborations with non-governmental organizations.
  - Sustainable funding available for stewardship of all private wells (whether they are posing a significant drinking water threat to a public water system or not).
  - Collection of further water characterization data for privately-serviced areas and further research into appropriate methods for determining vulnerable areas for these systems.

- If other rural areas in Canada are to consider a process similar to that under the CWA, they should carefully consider what aspects would make sense for their local context.

6.2.2. Future Research

The following topics are directions for future research resulting from this research:

- Ways to achieve greater flexibility within the planning process under the CWA to better allow for consideration of local concerns and approaches related to SWP.
- Ways to address the jurisdictional, cultural, social, and political complexities and considerations for properly engaging Indigenous peoples in SWP.
- Appropriate ways to include other systems (e.g. private drinking water well

clusters) into the CWA. This research could include a community-based research project exploring what were the challenges in the community of Trout Creek (located in the Municipality of Powassan) for elevating their well cluster into their local source protection plan.

- Regulatory mechanisms currently being implemented in municipalities in Ontario and elsewhere in order to protect sources of drinking water for privately-serviced areas (e.g., septic re-inspection by-laws, zoning, etc).
- How the *Safe Drinking Water Act, 2002* impacts SWP for privately-serviced areas.
- Systems to triage privately-serviced areas of great vulnerability and risk in order to prioritize SWP efforts in these areas.
- Research comparing the capacity for SWP in unorganized townships in rural Ontario compared to municipalities in rural Ontario.
- Further research evaluating SWP efforts using the frameworks for SWP capacity and collaborative watershed governance used in this research, in order to assess the robustness of these frameworks.

6.3. Implications and Conclusions

The SWP process under the CWA raised capacity for SWP in the rural communities impacted by the legislation and has contributed to improvements in collaborative watershed governance. Overall findings show both the strong presence and absence of the various elements of capacity for SWP and collaborative watershed governance

investigated, demonstrating the complexity of the issues involved. Despite the success to date of SWP in Ontario under the CWA, effort is required to support the capacity that has been developed, and to create sustainable fiscal frameworks for SWP in the province. The lack of a reliable provincial commitment to the process disproportionately impacts rural communities, which often do not have the internal capacity for SWP without the help of provincial funding and technical aid from conservation authorities. The absence of a continued provincial commitment to the SWP program under the CWA (both financially and otherwise), will impact the maintenance of required data and monitoring of source water supplies, enforcement of source protection plan policies, and public outreach and education efforts.

Previous research has found similar findings. Blackport and Dorfman (2014) explain,

> In the long term, the current model for establishing source water protection areas in Ontario may be successful because it is now mandated under the Clean Water Act and it is undertaken in consideration of watersheds. Ensuring these policies are implemented depends to a large extent upon the capacity (e.g. staff, financial resources and political support) of each municipality responsible for administering the protection policies, and their ability to translate the scientific understanding and policies into credible land-use decisions. (p. 225)

It can be seen that there are varying emphasis on certain capacity elements at different stages of SWP. For example, following the Walkerton tragedy in 2000 there was a clear need for an increase in institutional SWP capacity with the creation of new legislation, regulations, and policies, as well as initial financial capacity to building new SWP frameworks in Ontario. Additionally, during the first stage of creating the assessment

reports that guided the source protection committees in making science based policies in the source protection plans, there was an emphasis on technical capacity building with the need for watershed characterizations and modeling. However, now that the implementation of source protection plan policies is underway in municipalities impacted by the CWA, an emphasis will be on having the right human capacity to enact these policies, especially at the local level. Planners and other local level actors (such as the Risk Management Officials and Inspectors) will play an important part in implementing the land use planning changes associated with many of the policies created under the source protection plans.

Furthermore, greater attention to flexibility and the ability to address identified local concerns is important. The CWA's focus on exclusively SWP for municipal drinking water systems has left other communities such as First Nation communities (whose water systems are generally within Federal jurisdiction) and privately-serviced rural areas largely out of the process. These inclusion issues have negatively impacted the ability of the CWA to contribute to true collaborative watershed governance. Creative and effective public engagement strategies to encourage the interest of residents in protecting their water sources and giving them the technical aid to understand and enact SWP, are also necessary. Municipalities often need help delivering this kind of support to residents and conservation authorities have been helpful in this regard (e.g., through public outreach events).

A major limitation of this study was consideration of First Nations in SWP in Ontario (in

part due to the case studies chosen). Current research on First Nation communities and SWP planning in Ontario does highlight gaps between the regulatory requirements of the federal and provincial governments and the challenges for First Nations in Ontario. Collins, McGregor, Allen, Murray, and Metcalfe (2017) found that the provincial SWP planning process in Ontario does not address threats originating on reserve lands, and that there is a lack of funding to implement solutions to address threats that were identified through the SWP planning under the CWA. Eliminating barriers to participation in the provincial SWP program is important. Despite greater efforts to eliminate such barriers, there may be many First Nation communities who will still not choose to formally opt into the provincial legislative scheme as anything more than observers, for many valid reasons (e.g., the existence of their own source protection plan). This does not negate the need for providing opportunities for greater inclusion or the benefits of having these important watershed actors involved in the SWP process.

Careful consideration must be given to flexibility for the local context and capacities if other rural areas in Canada are to consider implementing a similar process to the CWA for SWP. Recommended practices related to policy translation for SWP call for "consideration of the political and institutional, resources and capacity, cultural, and biophysical contexts of the original and receiving jurisdictions" (de Loë & Murray, 2013, p.95). For example, place specific approaches may require varying public engagement methods, financial frameworks, regulatory approaches, and technical aid delivery. Provision of local technical aid may be difficult in jurisdictions without watershed organizations such as conservation authorities. It was suggested by interview participants

that non-governmental organizations could fill this role, such as local lake associations and other watershed based environmental organizations.

A question arising from this research is not only the transferability of the CWA to other rural areas in Canada, but its transferability to the privately-serviced areas of rural Ontario. As noted in Chapter 1, the interview guides for this research were focused on SWP capacity for rural serviced areas under the CWA (see Appendices 8.1 and 8.2). Therefore, the fact that there was such an emphasis by participants on the challenges for SWP in privately-serviced areas is an indicator that this is a very important topic for rural areas in Ontario. In fact, 12 participants (40%) indicated being privately-serviced is an important criteria for how they define areas as "rural". This research addressed the issue of privately-serviced areas, but as this wasn't the original focus of the research, more in-depth research is required.

The CWA and current implementation of the Act is now finally happening over 15 years after the Walkerton tragedy. Despite the slow roll out, it has been beneficial for protecting drinking water sources for public drinking water systems, and incredibly important for raising capacity for SWP in rural municipalities. Prior to Walkerton, there were policy tools available for municipalities to implement SWP. However, these tools were used on an ad hoc basis (de Loë, Kreutzwiser, & Neufeld, 2005; Plummer et al., 2010). The CWA now provides a mandated strategic legislative framework for SWP for public drinking water systems.

Many of the legislative tools for SWP in privately-serviced areas depend on how proactive the municipality is and the presence of various capacities Each element of capacity for SWP capacity (see Table 2.1) is important. If one element is missing it reduces the effectiveness of SWP efforts. For example, even if you had the strong presence of financial capacity, if there was no human capacity available to ensure SWP plans and policies were made and implemented correctly, SWP efforts would not be successful. This research shows there are institutional, technical/human, social, and financial capacity gaps for undertaking SWP in privately-serviced areas. Privately-serviced areas that fall within a wellhead protection area/intake protection zone and are deemed a significant drinking water threat to a public drinking water system do benefit from some of the policies in the source protection plans created under the CWA. However, there have been significant issues with elevating clusters of private wells into source protection plans under the CWA. This suggests the CWA is currently not an appropriate tool for the rural context for protecting private drinking water sources.

An implementable SWP planning and implementation framework should be developed that applies everywhere in Ontario. Policy makers need to be aware of the context that policy is implemented in to ensure effective implementation of policies. This research supports suggestions of previous studies and experiences that call for place specific policies for rural, rather than applying urban centric legislation, policies, and programs to rural areas (Canadian Rural Revitalization Foundation, 2015; Markey, Halseth, &

Manson, 2006). Presently, available SWP tools for privately-serviced areas are being implemented unevenly, and in some cases not at all (Worron, 2017). Previous research on water safety plans has found that having risk-based and proactive frameworks for water management eliminates the option for complacency (Kot, Castleden, & Gagnon, 2015). The CWA was not created for privately-serviced areas (though this was not clear when it was instituted) and has some significant limitations (especially if the provincial government continues to divest in the program). A new, strategic, implementable, and integrated institutional framework for SWP for privately-serviced areas is needed. Additional institutional, technical, social, and financial aid for SWP is needed in these areas. Furthermore, investments would be needed to increase human capacity at conservation authorities (for those privately-serviced areas located within a conservation authority boundary) or at MOECC regional offices and/or with regional environmental organizations (to help privately-serviced areas outside of conservation authority boundaries) in order to deliver such a framework. A new framework for SWP in privately-serviced areas should reflect that many privately-serviced areas fall outside the boundaries of a conservation authority. These areas may be unorganized townships that are often severely lacking in all elements of capacity for SWP.

This research suggests that capacity for SWP in privately-serviced areas must occur at different scales. One such scale is the well level, where private-well owners create and implement risk-based private wellhead protection plans to ensure stewardship of their drinking water supply. These plans require the support of regulation, financial incentives, and educational programs. However, these plans focus on the wellhead and not the

watershed. The second scale requiring attention in Ontario is protecting private well water resources at the watershed scale. There is a need for a cumulative level of protection for groundwater recharge areas serving these privately-serviced populations (Simpson, Duff, & Taylor, 2007) . Regulatory and non-regulatory changes are required in Ontario to properly enhance SWP at both these scales in order to protect these water supplies and populations adequately. Serious consideration of who could and should be involved in raising the technical capacity of private well owners should be undertaken (e.g., considering the role of provincial governments, municipal staff, public health units, conservation authorities, non-governmental organizations, etc.) (Ontario Auditor General, 2016).

Protecting drinking water supplies through SWP is a fundamental component of planning sustainable communities and safeguarding the human right to water (United Nations, 2015). However, as this research displays, implementing SWP is complex. This research has shown that collaborative watershed governance approaches, combined with adequate capacity for SWP efforts, are critical ingredients for facilitating SWP in rural areas. Ultimately, all people, no matter where they live, deserve access to safe and clean drinking water. We all have a role in SWP in order to ensure sustainable drinking water supplies for current and future generations.

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8. Appendix

8.1. Regional Interview Guide

Section A: Background Information on Respondent

1. What town do you live in?
    a. How long have you lived in your town?
    b. Do you consider where you live to be rural?
    c. How would you describe the definition of a rural town or area? In other words, what makes a town or area rural (or not)?
2. What is your profession? What is your role in your town/region (and/or in the province) that relates to drinking water?
3. Are you a paid part time/full time position? A volunteer? A resident and/or a water or watershed user (recreationally)?
4. How long have you been working/associated [with the subject town or agency]?
5. Are you involved in any other organizations in your town not covered above?
6. Have you completed any post-secondary education or training programs (including degrees, diplomas, certificates, water related training of any sort, etc.)?
7. Can you tell me a bit about your work history?

Section B: General Drinking Water Information

*To be collected from all participants excluding those being interviewed for their

positions at the provincial or federal level

8. How would you describe the quality of your local drinking water?
    a. Are you content with the drinking water quality in your town?
    b. Do you like the taste?
    c. Do you like the appearance?
    d. Has your opinion on the drinking water quality in your town changed over time?
9. How would you describe the quantity of your local drinking water?
    a. Are you content with the drinking water quantity in your town?
    b. Has your opinion on the drinking water quantity in your town changed over time?
10. Has the water system or drinking water source in your town ever faced any threats or have you had any issues with it that you have not already mentioned?
    a. Under what circumstances did these threats emerge (e.g. after a particular evident, access to a new information, etc.)?
11. What other sources of drinking water do people in your town use other than the publicly supplied drinking water (e.g. spring water, bottled water)?
12. What kind of development/land use is there in the vicinity of your town's water suppl(y/ies)?
    a. In the intake or wellhead protection area?

b. In the greater watershed/catchment?

13. ***If applicable:* In what ways do you think being "rural" affects your town's or region's drinking water quality and supply?

Section C: Technical Information

14. Are all drinking water supplies in the source protection area protected under your region's source protection plan (including public systems and private wells)?
15. What kinds of technical studies were undertaken for the planning process?
    a. Do you think these studies provided adequate information for planning?
    b. If no, what kind of information was missing?
16. Does the source protection plan for your region integrate other related plans such as other drinking water and waste management plans and regulations, land use plans, wetland protection plans, etc.?
    a. Can you tell me a little bit about how these plans interact with one another (or not)?
    b. For example, to what extent does existing local land use planning support the practice of SWP at a watershed or groundwater scale?
17. Has there been any evidence of changes in water quality or water quantity (either increases or decreases) since the implementation of SWP measures under the Clean Water Act?
    a. Describe any changes you have seen.
    b. How do you measure this?

18. Has there been a change in contamination risk due to the source protection plan? If yes, please explain?
    a. Has there been decreased risk? In what way?

Section D: Capacity

19. What are the main policies, regulations, legislation, and protocols that influence your SWP activities and measures?
20. In your experience, are the existing policies, regulations, legislation, and protocols under the source protection plan adequate to protect current and potential source water supplies now and into the future? Please explain.
21. Has the SWP planning process had adequate funding to complete source protection plans?
    a. How much did it cost? Who paid for it?
    b. To what extent, if at all, did financial resources limit the planning process?
22. Are there adequate funds to pay for implementation of SWP measures now? What about into the future?
    a. How much will implementation cost? Who funds implementation?
    b. To what extent, if at all, will lack of financial resources limit the implementation process?

23. Do your town's water rates for customers reflect the full cost of protecting and providing municipal drinking water (including treatment, distribution, maintenance, and SWP efforts)? Please explain.

24. What funding sources, if any, are available for municipal source water projects?

    a. Is this funding consistent over time?

25. Tell me a bit about the relationships among organizations in your town/region that share SWP as a common goal?

    a. What organizations are relevant?

    b. What is the nature of your current relationships with them with respect to SWP?

    c. Did these exist before the SWP planning process?

26. How would you describe the degree of technical knowledge in your organization in regards to drinking water sources and their potential threats?

27. How would you describe the degree of technical knowledge generally at the local level (e.g., municipal government, landowners, the general public) in regards to drinking water sources and their potential threats?

    a. Do those who are required to enact source protection policies (e.g., municipal government, landowners) have the technical knowledge to do so?

28. To what extent, and how, has the SWP planning process contributed to the development of local technical knowledge of source waters and their potential threats?

a. For example, was education or other forms of capacity-building part of the SWP planning process?

b. Is it expected to be ongoing throughout implementation?

Section E: Governance

29. How were source protection committees designed?

    a. How were roles and responsibilities established?

    b. Who decided on the limits of inclusion and participation?

    c. To what extent, and how, did stakeholders participate in the selection of source protection committees?

    d. Were the right actors at the table during the planning process? Please explain.

    e. Did it involve all key agencies with related responsibilities? Explain.

30. How were plans created?

    a. To what extent, and how have stakeholders participated in the selection and development of SWP tools, the created policies and the overall implementation strategy?

    b. Was the public consulted in the planning process? If so how?

    c. Did the public have the ability to influence decision-making?

31. Has it been beneficial to SWP to have the SWP planning and implementation process legislated under the Clean Water Act?

32. Did the source protection planning process and decision making balance economic, social and environmental values? Explain/provide examples.

33. To what extent did it bring government and non-government actors together to make shared decisions? Explain.

34. ***may have been answered by question 27**** Was the planning process a place where knowledge sharing and learning was important?

    a. Were different types of learning opportunities provided during the planning process?

    b. Did learning opportunities cause changes in attitudes, behaviours, and actions either

35. ***may have been answered in section D**** Is there adequate financial and technical support available for landowners for the implementation of the plan?

    a. Has community awareness and support for watershed protection been developed through the SWP process? How has this happened?

36. Was there a feeling of trust and respect during the planning process?

    a. Now that implementation is underway do all stakeholders understand their role in implementation?

    b. Do stakeholders understand others roles in implementation?

    b. ***may have been answered in question 25**** Has the planning process created increased communication amongst watershed stakeholders?

c. Has there been a willingness amongst authorities to share data and to coordinate activities related to SWP?

d. Has the process fostered public trust? Do you believe there was adequate time for the public to review the plan?

37. If conflict arose during the planning process, either amongst the source protection committee or with the public, how was it dealt with?

38. Are the policies created under the source protection plans fair to both rural and urban areas in your view? How are the interests of rural and urban areas balanced?

39. Did everyone on the source protection committee have equal power to make decisions?

40. Did everyone on the source protection committee have a common vision and believe what they were doing was beneficial for their drinking water?

41. Were all the policies created under the source protection plan beneficial to source protection and appropriate for your region/local circumstance?

    a. Do those who have to implement SWP policies in your region believe the policies are appropriate and beneficial to SWP protection?

42. What are some of the long-term goals of your region's source protection plan?

43. How often are plans reviewed?

44. How will new knowledge be incorporated to improve source protection plans into the future?

a. Is there flexibility into the future for plans and policies to change depending on changing conditions?

b. ***may have already been answered in question 21**** Is there a fiscal framework for funding implementation of policies and the updating of information into the future?

45. Is the finalized source protection plan an appropriate document for protecting source water supplies in your region?

46. Did the SWP planning process create source protection policies that will be enacted by all institutions and actors that must implement them?

    a. Is there a group who will be taking a lead in the assessment and monitoring of implementation?

    b. How are stakeholders and decision makers made accountable for the decisions and commitments made?

    c. Are there any inter municipal agreements or something like that (or agreements with other groups) to enact SWP policies (asides from the source protection plan)?

Section F: Policy Transfer for Rural Areas

47. Has the SWP process in Ontario been successful overall in protecting drinking water supplies in rural Ontario?

48. Thinking particularly for rural areas, do you think the SWP process in Ontario would be appropriate for other places in rural Canada? Why or why not considering factors related to cost, capacity and impacts for rural areas?
49. If Ontario's SWP model was used by another area, what advice would you give them as far as the resources they would need and institutions that would need to be in place, for example?
    a. Would other areas need conservation authorities or similar watershed organizations to facilitate the process?

Section G: Closing Questions

50. Is there anything else you would like to add?
51. Are there any documents I should read or other contacts I should speak to that you would like to suggest?
52. Is there anything I can provide back in terms of information that you would be interested in? (*Get contact information, if not already recorded*.)

8.2.Provincial Interview Guide

Section A: Background Information on Respondent

1. What town do you live in?
    a. Do you consider where you live rural?
    b. What is your definition of rural?
2. What is your profession? What is your role in your town/region (and/or in the province) as it relates to drinking water?
3. Have you completed any post-secondary education or training programs (including degrees, diplomas, certificates, water related training of any sort, etc.)?
4. Can you tell me a bit about your work history?

Section B: Capacity

5. Has the SWP planning process had adequate funding to complete source protection plans?
    a. How much did it cost? Who paid for it?
    b. To what extent, if at all, did financial resources limit the planning process?
6. Are there adequate funds to pay for implementation of SWP measures now? What about into the future?
    a. How much will implementation cost? Who funds implementation?

b. What funding sources, if any, are available for municipal source water projects?

    i. Is this funding consistent over time?

7. How much did the whole process cost?

    a. Per SPA/Region?

    b. Across the province?

8. Do those who are required to enact source protection policies (e.g., municipal government, landowners) have the technical knowledge to do so?

9. To what extent, and how, has the SWP planning process contributed to the development of local technical knowledge of source waters and their potential threats (both in the Cataraqui/North Bay-Mattawa source protection area and elsewhere)?

    a. For example, was education or other forms of capacity-building part of the SWP planning process?

    b. Is it expected to be ongoing throughout implementation?

Section C: Governance

10. How were source protection committees designed?

    a. How were roles and responsibilities established?

    b. Who decided on the limits of inclusion and participation?

    c. To what extent, and how, did stakeholders participate in the selection of source protection committees?

d. Were the right actors at the table during the planning process? Please explain.

e. Did it involve all key agencies with related responsibilities? Please explain.

11. How were plans created?

    a. To what extent, and how have stakeholders participated in the selection and development of SWP tools, the created policies and the overall implementation strategy?

    b. Was the public consulted in the planning process? If so how?

    c. Did the public have the ability to influence decision-making?

12. Has it been beneficial to SWP to have the SWP planning and implementation process legislated under the Clean Water Act?

13. Did the source protection planning process and decision making balance economic, social and environmental values? Explain/provide examples.

14. How did provincial government departments work together on the SWP?

    a. Has there been a willingness amongst authorities to share data and to coordinate activities related to SWP?

15. How often are plans reviewed?

16. How will new knowledge be incorporated to improve source protection plans into the future?

    a. Is there flexibility into the future for plans and policies to change depending on changing conditions?

b. ***may have already been answered*** Is there a fiscal framework for funding implementation of policies and the updating of information into the future?

17. Is the Cataraqui/North Bay-Mattawa Source Protection Plan adequate to protect current and potential **rural** source water supplies now and into the future? Please explain.
    a. What about other plans for the SPA/Regions you have worked with?
18. Are you aware of any municipalities or communities that have "opted-in" to a source protection plan?
    a. What were the reasons for this?
    b. What was the process for opting in?
19. In the future, will there be an expansion of the CWA to unserviced rural areas where residents and public buildings rely on a drinking water source that is not a part of a municipal system or not within a SPA/Region?
    a. What would be the barriers to this?
20. Are you aware of any other legislative or regulatory power that a municipality can use to protect source water supplies for unserviced areas such as those residents who rely on private well or surface water systems?
    a. What about those residents not within an organized municipality?

Section D: Policy Transfer for Rural Areas

21. Thinking particularly for rural areas, do you think the SWP process in Ontario would be appropriate for other places in rural Canada? Why or why not considering factors related to cost, capacity and impacts for rural areas?
22. If Ontario's SWP model was used by another area, what advice would you give them as far as the resources they would need and institutions that would need to be in place, for example?
    b. Would other areas need conservation authorities or similar watershed organizations to facilitate the process?

Section E: Closing Questions

23. Is there anything else you would like to add?
24. Are there any documents I should read or other contacts I should speak to that you would like to suggest?
25. Is there anything I can provide back in terms of information that you would be interested in? (*Get contact information, if not already recorded*.)

8.3.Knowledge Brief #1: Ontario's *Clean Water Act* and Implications for Rural Serviced Municipalities

KNOWLEDGE BRIEF #1

Ontario's *Clean Water Act* and Implications for Rural Serviced Municipalities

Questions? Comments? Feedback? E-mail Sarah Minnes, PhD Candidate, Memorial University of Newfoundland: sminnes@grenfell.mun.ca

Executive Summary

The *Clean Water Act* in Ontario was instituted after the Walkerton tragedy, as part of the suite of recommendations made by Justice O'Connor in the *Walkerton Inquiry* (Baird, Plummer, Morris, Mitchell, & Rathwell, 2014; de Loë, Murray, Michaels, & Plummer, 2016; O'Connor, 2002). During the Walkerton tragedy seven people died and 2300 became seriously ill due to a contaminated municipal water supply (de Loë et al., 2016; Livernois, 2002). Under the *Clean Water Act* source protection committees (with a wide range of stakeholders) created source protection plans on a watershed basis, with the assistance of the source protection authorities (conservation authorities), and the Ministry of the Environment and Climate Change (who led and has overseen the entire process) (Ministry of Environment and Climate Change, 2017; Ontario Ministry of Environment, 2006). Using a capacity framework (see page 2), this knowledge brief outlines the findings of research conducted in order to evaluate implications of the *Clean Water Act* for rural serviced municipalities (i.e. municipalities with municipally operated drinking water systems).

It was found through this research that the process under the *Clean Water Act* did improve capacity for source water protection in the serviced municipalities who were involved in the planning process and are impacted by the source protection plans. The most prominent challenges with the process under the *Clean Water Act* were a lack of: flexibility for local circumstance when assessing what can be a binding policy in the source protection plans; effective engagement of First Nations; effective engagement of the general public; and sustainable funding for implementation and needed human resources due to diminished provincial government support. The findings of this research highlight that source water protection in rural areas need: the commitment of the local level (e.g., decision makers, municipal staff, local health units, residents, watershed users) to source water protection; mandatory and enforceable legislation; sustainable municipal financial frameworks and provincial funding for source water protection planning and ongoing implementation; and technical assistance, particularly at the regional level.

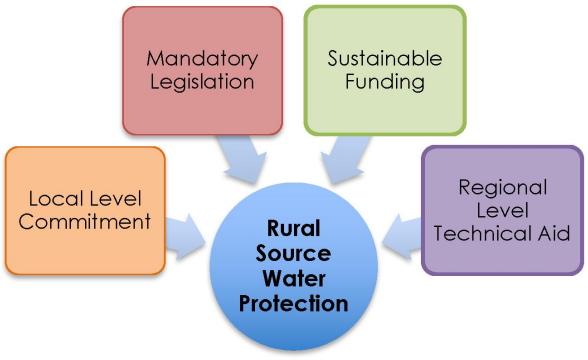

Figure 1: Factors Needed for Rural Source Water Protection

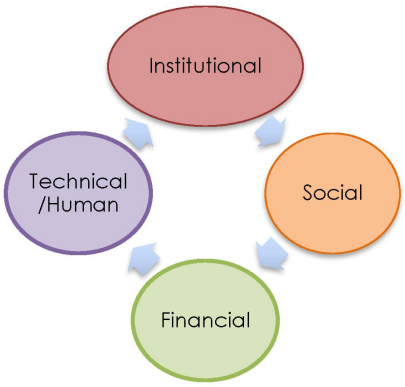

Figure 2: Elements of Capacity for Source Water Protection

Why is this Important?

Source water protection is an important first barrier to ensuring drinking water safety (de Loë et al., 2016; Hrudey, Payment, Huck, Gillham, & Hrudey, 2003). Source water protection refers to the protection of the surface and groundwater supplies that are used for drinking water (Ivey, de Loë, Kreutzwiser, & Ferreyra, 2006). Not only is source water protection beneficial to the environment and safety of drinking water, it is also economically advantageous. For example, remediation efforts after a contamination has already taken place can cost 30 to 40 times more than preventative source water protection programs, with costs rising to as much as 700 times more costly in rural areas (Simpson & de Loë, 2014) .

In many rural communities across Canada, there are capacity related constraints that impede their ability to adequately implement source water protection (Kot, Castleden, & Gagnon, 2011; Minnes & Vodden, 2017; Patrick, 2011). Elements of capacity for source water protection include: social (e.g., networks, social norms), technical/human (e.g., data available, skilled human resources), financial (e.g., funding for source water protection plans and ongoing implementation), and institutional (e.g., legislation, governance structures) (Ivey et al., 2006; Minnes, 2017; Noble & Basnet, 2015; Rawlyk & Patrick, 2013; Robins, 2008; Timmer, de Loë, & Kreutzwiser, 2007). In order to improve the ability of rural communities to adequately implement source water protection measures, systems must be in place to build and maintain capacity for source water protection.

Challenges and Successes with the *Clean Water Act* for Rural Areas

Findings from this research conclude that capacity for source water protection was built in rural municipalities located in the two case study regions (the Cataraqui Source Protection Area and the North Bay- Mattawa Source Protection Area). The program was of particular benefit for those rural municipalities who previously lacked the internal capacity to conduct many of the assessment activities and a venue to discuss source water protection at the watershed/regional level. However, there were both challenges and successes revealed regarding the process under the *Clean Water Act* that are summarized below in Table 1 according to the element of capacity for source water protection that it corresponds with.

Table 1: Key Findings- Capacity for Source Water Protection and Ontario's *Clean Water Act* (Minnes, 2017)

Element of Capacity	Challenge	Success
Institutional	• Not enough flexibility for locally relevant concerns (e.g., Great Lakes, private well clusters, pipelines). • Lack of involvement of First Nation communities' in source protection committees and plans (there was indication by key informants this is being looked into). • The exclusion of certain communities from the mandatory protection of the *Clean Water Act* (e.g., private drinking water systems). • Program and technical guidelines were not fully scoped resulting in inefficiencies, frustrations, and an overall very lengthy process.	• Creation of mandatory and enforceable legislation. • Creation of a clear governance structure and delineation of implementation responsibilities.

Challenges and Successes Continued…

Element of Capacity	Challenge	Success
Financial	• Ongoing implementation, monitoring and evaluation funding from the provincial government is unknown. This impacted some decisions made in source protection plans (i.e., inclusion of private well clusters, policies requiring risk management officials). • Financial ownership of the program is lacking at the municipal level, especially in rural municipalities. • Diminishing provincial funding has resulted in a loss of human capacity at the conservation authorities.	• Over $250 million of provincial funding provided to the program and related activities (Ministry of Environment and Climate Change, 2017).
Social	• Understanding of the need for source water protection and drinking water in general was variable in both regions. • Better engagement techniques are required that address barriers to involvement (e.g. long distances to travel to events, lack of an understanding of the technical material, rural residents' aversion to regulation and land use restrictions).	• Process provided educational opportunities to the public as well as municipal staff and elected officials, increasing awareness about source water protection. • Process convened a diverse range of stakeholders together on the source protection committee, creating new networks for communication and data sharing.
Technical/Human	• Some municipal staff and elected officials do not have the expertise to understand the need for source water protection, making re-education programs with every election cycle imperative. • There were some issues with the technical guidelines (e.g., Tables of Drinking Water Threats, vulnerability ratings, and capture zone delineations). • As provincial funding declines so does the maintenance of technical/human capacity. The lack of guaranteed future funding for continual evaluation and monitoring of local circumstance is a concern. Particularly, in order to keep data and policies up to date in regard to current and future threats.	• Data created and shared during the creation of the assessment reports, increased technical capacity, especially for rural municipalities. • Human capacity for source water protection efforts increased at the conservation authorities and some municipalities. • The provincial government and conservation authorities provided technical support to municipalities, aiding in creating understanding about reasons for source water protection and their role in implementation. • Technical capacity was raised for those on the source protection committees via educational resources, presentations and co-learning.

Recommendations

The main recommendations from this research are:

- As upper level governments download responsibilities to municipal levels, funding frameworks need to be considered. Realistic fiscal frameworks should be created between provincial and municipal bodies to sustain source water protection efforts (including up to date data, further source protection plan updates, expert human resources at the municipal and/or conservation authority levels, ongoing monitoring and evaluation, data sharing networks, and public outreach efforts). Regional collaborations could offer value in this matter.
- Further work needs to be done to create better ways to specifically engage First Nations in the process,
- Fostering better public engagement in the source water protection process is needed. Help from non-governmental organizations in engagement efforts could aid in diversifying engagement techniques and participating audiences.
- Further research needs to be done on appropriate ways to include other systems (e.g. private drinking water well clusters) into the *Clean Water Act*.
- It was suggested by research participants that if other rural areas in Canada were to consider a process similar to that under the *Clean Water Act*, they should carefully consider what aspects would make sense for their local context.

The Research Project and Next Steps

This research is part of an Interdisciplinary PhD dissertation exploring the role of governance and capacity building in source water protection for rural regions. This research has employed a case study approach using two source protection areas in Ontario (the Cataraqui Source Protection Area and the North Bay-Mattawa Source Protection Area). Field research began for this project in March of 2016 and data collection has now ended. Data collection consisted of a total of 30 key informant interviews in the case study regions and provincially, using a semi-structured interview guide. Further literature review, legislation review, document review, and meetings to discuss findings with a select number of key informants were also conducted. Analysis is currently underway for two further peer-reviewed papers that will result from this research on the following subjects:

- Capacity for source water protection in Ontario for unserviced rural areas
- Collaborative watershed governance and Ontario's *Clean Water Act*

Knowledge briefs will be created for each paper and disseminated to key informants and other experts in the field for feedback. These papers, as well as a complete literature review on the subject matter and final conclusions, will be combined in a final doctoral dissertation. This will be finalized by summer of 2018.

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8.4.Knowledge Brief #2: Capacity for Source Water Protection in Ontario's Privately-Serviced Rural Areas

Questions? Comments? Feedback? E-mail Sarah Minnes, PhD Candidate, Memorial University of Newfoundland: sminnes@grenfell.mun.ca

Executive Summary

This research examined the capacity for source water protection in Ontario in privately-serviced rural areas. Privately-serviced areas refer to communities where residents do not derive their drinking water from publically operated water systems. When considering specifically rural drinking water in Ontario, the most common source of water is groundwater fed private wells (Simpson, 2004). The ability to perform source water protection in these areas was explored through a capacity framework. The framework considered the following elements of capacity: social (e.g., networks, social norms), technical/human (e.g., data available, skilled human resources), financial (e.g., funding for all source water protection efforts), and institutional (e.g., legislation, governance structures) (Ivey, de Loë, Kreutzwiser, & Ferreyra, 2006; Minnes, 2017; Noble & Basnet, 2015; Rawlyk & Patrick, 2013; Robins, 2008; Timmer, de Loë, & Kreutzwiser, 2007). It was found that privately-serviced rural communities, often do not have drinking water as one of their mandated responsibilities. In a time of constant downloading of responsibilities, these small municipalities often lack the ability to enact source water protection efforts without technical aid from regional level organizations (such as Conservation Authorities) or regional provincial government staff, as well as financial aid from the provincial government.

The use of many of the regulatory tools (e.g., enacting septic reinspection by-laws) that can be used for source water protection in privately-serviced areas, depends on how proactive the municipality is and the presence of various capacities. This research shows there are social, technical/human, financial and institutional capacity gaps for undertaking source water protection in privately-serviced areas. For example, the *Clean Water Act,* 2006 protects 90% of Ontarians, but does not meaningfully protect privately-serviced rural areas. Research found those privately-serviced areas that fall within a vulnerable area for a public drinking water system do benefit from some of the policies in respective source protection plans created under the *Clean Water Act,* 2006. However, there are significant barriers to including clusters of private wells in source protection plans under the *Clean Water Act, 2006*. This suggests the *Clean Water Act* is currently not an appropriate tool for the rural context for protecting private drinking water sources. Investigation is needed into options for a new, integrated, implementable and context appropriate source water protection framework for privately-serviced rural areas in Ontario.

Table 1: Examples of Possible Contaminants to Private Wells (Simpson, 2004)

	Examples
Pathogens	• Bacteria (e.g., *Campylobacter jejuni, Escherichia coli, Salmonella, Shigella*) • Protozoans (eg., *Giardia lamblia, Cryptosporidium parvum, Entamoeba histolytica*) • Viruses (e.g., Hepatitis A, Norwalk, Rotavirus)
Parameter	• Nitrate • Pesticides • Solvents

Why do Private Wells need Source Water Protection?

In Ontario, 98% of rural residents (and one-third of all Ontarians) rely on private well water as their primary drinking water source (Public Health Ontario, 2017). It has been found that in Ontario, those served by private systems may be at greater risk of waterborne illness than those residents served by municipally operated (i.e. public) drinking water systems (Murphy, Thomas, Schmidt, & Medeiros, 2016). Previous research has found that home owners need to be educated on their responsibilities for safely operating their private wells. It was found that, "public engagement on the issue of safe well water and stewardship continues to be limited by complacency, inconvenience, cost and privacy concerns" (Murphy et al., 2016, p. 1365). Source water protection (the protection of the surface and groundwater supplies that are used for drinking water) is an important first line of defense in protecting drinking water (Ivey, de Loë, Kreutzwiser, & Ferreyra, 2006). As source water protection may be the only barrier of defense from water contamination (when treatment and monitoring is lacking), outreach and education related to source water protection for private systems is of the utmost importance for the health of rural residents (Simpson, Duff, & Taylor, 2007).

Challenges and Successes for Source Water Protection in Privately-serviced Rural Areas

Findings from this research conclude that there is currently a need for a great deal of capacity building to achieve adequate source water protection in privately-serviced areas in Ontario. Table 2 outlines the key findings of this research. Key findings outline the most frequently expressed challenges/successes noted by key informants.

Table 2: Key Findings- Challenges and Successes for Source Water Protection in Privately-Serviced Rural Areas

Element of Capacity	Challenges	Successes
Institutional	• Inadequate institutional frameworks for source water protection for privately-serviced areas in Ontario. • During source protection planning under the *Clean Water Act, 2006*, source protection committees were encouraged by the Ministry of the Environment and Climate Change staff to not elevate clusters of private wells (i.e. privately-serviced areas) into their source protection plans. • Legislating source water protection for rural, privately-serviced areas, has to be done differently than the process for municipal systems under the *Clean Water Act, 2006*.	• Legislation and regulations that protect privately-serviced drinking water supplies (e.g., *Clean Water Act, 2006, Ontario Water Resource Act, 1990*). • Privately-serviced areas within a municipal intake/wellhead contributing area under the *Clean Water Act, 2006* benefit from the protection of the *Clean Water Act, 2006* and associated source protection plans.

Challenges and Successes Continued...

Element of Capacity	Challenges	Successes
Financial	• Fear of financial impacts of source water protection at the regional/municipal level. • Fear of the financial impacts of source water protection at the household level. • Absence of provincial level financial commitments to source water protection in privately-serviced areas.	• Financial incentives for source water protection efforts in privately-serviced areas.
Social	• A need to increase education and outreach efforts to those in privately-serviced areas regarding source water protection and drinking water related threats. • Rural cultural norms, such as resistance of regulations, may be a barrier to source water protection in privately-serviced areas.	• Provincially funded source water protection education and outreach efforts have raised social capacity in privately-serviced areas. • Non-governmental organizations were noted as important actors in increasing social capacity for source water protection in privately-serviced areas. • Some lower and upper tier municipal officials were supportive of source water protection in privately-serviced areas, which has helped with greater awareness of water issues in the area. • Societal norms are changing about water issues, and there is now more awareness about environmental issues in general.
Technical/Human	• Concerns about the ability of the human capacity in privately-serviced areas to adequately implement source water protection. • Modelling and technical approaches for determining vulnerable areas around clusters of wells elevated into the source protection plans under the *Clean Water Act, 2006* are still in progress. • Noted lack of availability of groundwater data for privately-serviced areas and a need for further studies to be conducted.	• Provincial legislation and regulations have purposefully or inadvertently raised technical capacity for source water protection in privately-serviced areas. Most notably these include the *Clean Water Act, 2006* and Wells Regulation 903,1990 under the *Ontario Water Resources Act, 1990.* • Some municipalities have taken a proactive stance regarding source water protection in their privately-serviced areas.

Recommendations

- Investigation is needed into options for a new, integrated, implementable and context appropriate source water protection framework for privately-serviced rural areas in Ontario. This framework should include:
    - Sustainably funded outreach and education programs for private well owners. These efforts should include creative and effective public engagement strategies and collaborations with non-governmental organizations.
    - Sustainable funding available for stewardship of all private wells (whether they are located in a vulnerable area of a public water system or not).
    - Collection of further water characterization data for privately-serviced areas and further research into appropriate methods for determining vulnerable areas for these systems.
- Implement source water protection programs designed for rural (e.g., Cataraqui Region Conservation Authorities' Groundwater Protection Plan, a landowner self-assessment workbook used as a tool to score groundwater vulnerability on a property-specific scale).
- Further research into regulatory mechanisms currently being implemented in municipalities in order to protect sources of drinking water for privately-serviced areas.

The Research Project and Next Steps

This research is part of an Interdisciplinary PhD dissertation exploring the role of governance and capacity building in source water protection for rural regions. This research has employed a case study approach using two source protection areas in Ontario (the Cataraqui Source Protection Area and the North Bay-Mattawa Source Protection Area). Field research began for this project in March of 2016 and data collection has now ended. Data collection consisted of 30 key informant interviews in the case study regions and provincially, using a semi-structured interview guide. Further literature review, legislation review, document review, and meetings to discuss findings with a select number of key informants were also conducted. Other papers outlining the findings of this research include:

- Ontario's *Clean Water Act* and Implications for Rural Serviced Municipalities
- Watershed Governance or Intake Governance? Implications of Ontario's *Clean Water Act* for Collaborative Watershed Governance in Rural Areas

Knowledge briefs have been created for each paper and disseminated to key informants and other experts in the field for feedback. These papers, as well as a complete literature review on the subject matter and final conclusions will be combined in a final doctoral dissertation. This will be finalized by summer of 2018.

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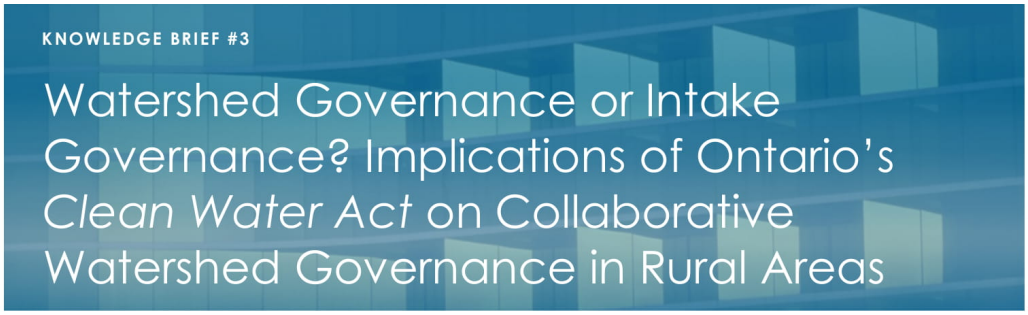
8.5 Knowledge Brief #3: Watershed Governance or Intake Governance? Implications of Ontario's Clean Water Act on Collaborative Watershed Governance in Rural Areas



Questions? Comments? Feedback? E-mail Sarah Minnes, PhD Candidate, Memorial University of Newfoundland: sminnes@grenfell.mun.ca

Executive Summary

The inquiry report, following the Walkerton tragedy, found that a lack of source water protection was a key contributor to the contamination of Walkerton, Ontario's municipal drinking water supply (Christensen, 2011). This finding led to stricter source water protection legislation and new governance structures for source water supplies in Ontario through the *Clean Water Act, 2006* (Murray & de Loe, 2012). Source water protection under Ontario's *Act* was designed to be an integrated, science-based approach, using multi-level governance structures to create source protection plans on a watershed basis (Ontario Ministry of Environment, 2006). The governance structures under the *Clean Water Act, 2006* can be seen to be an example of collaborative watershed governance. Particularly, through the source protection committees, there was a bringing together of various actors on a watershed basis to produce source protection plans.

It was found through this research that the source protection planning process under the *Clean Water Act, 2006* improved communication, collaboration, transparency, integration, knowledge sharing and trust at the watershed level. However, there are still improvements to be made to make this process a model example of collaborative watershed governance. As found in previous research, governance arrangements are often considered important for promoting watershed protection. However, factors such as uncertainty, complexity, fragmentation, lack of incentives to cooperate, knowledge gaps, and inclusion issues can prove to be challenges to watershed governance (Booher & Innes, 2010; Memon & Weber, 2010). These are all elements that need to be considered moving forward with source protection planning and implementation under the *Clean Water Act, 2006*. Communities and individuals who are located within the watersheds contributing to source water supplies need to better see their role in source protection efforts. Factors such as the inflexibility for local concerns in the legislated planning process, unknown future funding for implementation efforts and a lack of public interest, have all negatively impacted the effectiveness of the collaborative watershed governance of source water supplies in Ontario. In the case study source protection areas used in this research (the Cataraqui Source Protection Area and the North Bay-Mattawa Source Protection Area), it was found there was a lack of ownership of the source protection plans for those communities within the source protection areas who were not impacted by binding policies. There is a need for the source protection process under the *Clean Water Act, 2006* to better involve the entire watershed in future planning efforts.

Why is Collaborative Watershed Governance Important?

Table 1: Elements of Collaborative Watershed Governance

Elements
Legislated process/organized structure
Integration
Right actors at the table
Shared ownership and accountability
Knowledge sharing and learning
Public participation
Trust building and transparency
Fairness
Adequate resources and capacity
Common benefit evident
Evaluation, adaptability, and flexibility

Cohen (2012) explains that governance is the act of decision-making, opposed to management, which refers to the day-to-day technical actions taken on what is being governed. Collaborative governance brings together public and private stakeholders in collective forums to engage in consensus-oriented decision making (Ansell & Gash, 2008). Polycentric systems created by collaborative governance have been found to enhance innovation, learning, adaptation, trustworthiness, levels of cooperation among participants, and the achievement of more effective, equitable, and sustainable outcomes (Pahl-Wostl, Becker, Knieper, & Sendzimir, 2013). Collaborative governance arrangements improve the ability to resolve collective action problems, help scholars develop understanding of elements associated with institutional durability, and make policies more robust and effective (Weber, 2012). Bidwell and Ryan (2006) outline a growing preference for new governance strategies in collaborative watershed partnerships that are decentralized, participatory, and involve consensus-based problem solving in conjunction with traditional bureaucratic institutions. Authors such as Vodden (2014) and Reed & Bruyneel (2010), suggest that solutions for water problems must involve interaction between both governmental and non-governmental actors and that collaboration between these actors enhances the effectiveness of water policies and plans.

Challenges and Successes for Collaborative Watershed Governance

The elements of collaborative watershed governance (see Table 1) were assessed looking at specific indicators of each element. Many of the indicators found related to these individual elements of collaborative watershed governance overlapped during analysis. Therefore, main overall findings are outlined below in Table 2. Key findings represent the most frequently expressed challenges/successes noted by key informants in relation to collaborative watershed governance in rural areas under the *Clean Water Act, 2006*.

Table 2: Key Findings- Challenges and Successes for Collaborative Watershed Governance

	Key Finding
Successes	• The legislated and organized governance structure of the *Clean Water Act, 2006* was beneficial for watershed collaboration, providing clear formalized responsibilities and rules related to governance, data collection and implementation. This clarity enhanced trust, transparency, integration and knowledge sharing amongst watershed actors. • The planning process under the *Clean Water Act, 2006* increased communication at the watershed level about water quality issues in general. • The planning process under the *Clean Water Act, 2006* was designed to foster knowledge sharing and learning amongst watershed stakeholders. • Science based policies aided in watershed stakeholders' buy in of source protection plans and related policies.

Challenges and Successes Continued…

	Key Findings
Successes	• The *Clean Water Act, 2006* and related decision-making processes integrated other related legislation to fill in identified policy gaps. • The increase of capacity at the Conservation Authority level during the planning process under the *Clean Water Act, 2006* has provided important local, context specific guidance to decision makers and implementers at the watershed level. • The source protection committees were the right mix of actors needed for collaborative watershed governance and aided in the balancing of social, economic, and environmental considerations within the source protection plans. The diverse source protection committees also engaged diverse stakeholders. • The consensus-oriented decision-making process at the source protection committee table allowed for healthy debate and room for productive conflict. • Data sharing amongst provincial, regional and municipal government departments and local non-governmental organizations was high during the assessment and planning stages of the source protection plans under the *Clean Water Act, 2006*.
Challenges	• The assessment work, planning process and final source protection plans were focused on protecting public water systems' wellhead protection areas/intake protection zones, rather than utilizing a true watershed approach. • Much of the technical information presented at public events was not fully understood by the intended audience. This impacted the level and quality of public engagement. • Inflexibility for local concerns and innovations impacted feelings of ownership and common benefit towards the plan amongst the source protection committees and other stakeholders within the source protection areas. • Better engagement techniques are needed to involve participants, including incentives for all watershed stakeholders to become active in the planning and implementation process. • Unknown and diminished implementation funding will impact the overall commitment and quality of implementation, evaluation, and adaptation of plans into the future • The planning process under the *Clean Water Act, 2006* was noted as not being designed for privately-serviced rural areas. For example, the only binding mechanism for protection of their systems was elevating clusters of private wells into the source protection plan. This was discouraged by provincial staff and seen as an unfair process by the one privately-serviced community that was elevated into their local source protection plan. • The missions, objectives, and scope of the planning process under the *Clean Water Act, 2006* did not always stay constant. • Privately-serviced municipalities within the source protection areas lacked ownership and feelings of common benefit related to the planning process and the policies under the source protection plans. • There was a lack of representation of First Nation communities and limited feelings of ownership of the source protection plans by First Nation communities within the source protection areas.

Recommendations

- There is a need for the source protection process under the *Clean Water Act, 2006* to better involve the entire watershed in future source water protection planning efforts. This approach would involve meaningful inclusion of all communities within the source protection areas, especially those who may be located outside of a wellhead protection area and/or intake protection zone and those relying on private drinking water systems.
- More research needs to be given into ways to achieve greater flexibility within the planning process under the *Clean Water Act, 2006* to better allow for consideration of local concerns and approaches related to source water protection.
- There is a need for better translation of technical information to the general public in order to achieve true stakeholder engagement, opposed to stakeholder consultation.
- Consideration for periodically different locations for source protection committee meetings so that committee members located far away from urban centres are not consistently having to travel long distances. Also, the option of electronic participation in these meetings could be beneficial, especially during winter months.

The Research Project and Next Steps

This research is part of an Interdisciplinary PhD dissertation exploring the role of governance and capacity building in source water protection for rural regions. This research has employed a case study approach using two source protection areas in Ontario (the Cataraqui Source Protection Area and the North Bay-Mattawa Source Protection Area). Field research began for this project in March of 2016 and data collection has now ended. Data collection consisted of 30 key informant interviews in the case study regions and provincially, using a semi-structured interview guide. Further literature review, legislation review, document review, and meetings to discuss findings with a select number of key informants were also conducted. Other papers outlining the findings of this research include:

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